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## Index to Volume XXXV

[Titles printed in SMALL CAPITALS refer to original articles; those in lower case to abstracts, and those in *italics* to editorial articles. \* before a page number refers to the Anesthesia Supplement.]

	PAGE		PAGE		PAGE
<b>A</b>		ALBEE, FRED H. — OPERATIVE		ANESTHESIA, CARBON DIOXID AD-	
ABBOTT, WALLACE C.—(Obit-		TREATMENT (ARTHRODESIS) FOR		MINISTRATION AFTER.—REIMANN,	
uary) .....	247	OSTEO-ARTHRITIS OF THE HIP....	296	S., AND OTHERS.....	*77
Abdominal Diseases, Diagnosis....	45	ALLEN, CARROLL W.—THYROID-		—CHARTING THE SIGNS AND SYMP-	
Abortion Complicated by Sepsis....	201	ECTOMY UNDER LOCAL ANESTHESIA	*12	TOMS FOR TEACHING PURPOSES.—	
ABSCESS. See REGION OF ABSCESS..		ALVEOLECTOMY, EXTERNAL ( <i>Letter to</i>		PEEBLES. ....	*100
ACIDOSIS FOLLOWING OPERATION,		<i>Editor</i> ).—NOVITZKY. ....	66	—DOSIMETRIC CHLOROFORM AND	
SOME OBSERVATIONS ON THE OC-		American Association of Anesthetists	*61	ETHER VAPOR: SOME REFLECTIONS	
CURRENCE OF.—ROSS .....	*121	<i>American Public Health Association,</i>		OF A SICK ANESTHETIST.—HIRSCH.	*23
<i>Actinomycosis</i> .....	197	<i>Semi-Centennial of the</i> .....	360	—ETHER VAPOR. See DAVIS.....	*37
<i>Acute Anatomy</i> .....	67	ANAL MUSCLES, PRESERVATION IN		—FOR OPERATIONS ON CHILDREN.—	
Adenopathy, Malignant, of Foot....	41	OPERATION. See HANES. ....	373	BEACH. ....	*71
AIR-CONTROL AS A MEANS OF REDUC-		—PAPILLAE, HYPERTROPHY OF THE.		—In Goiter. See Goiter; Hyperthy-	
ING THE POST-OPERATIVE DEATH		—HAWLEY. ....	378	roidism; Thyroidectomy. ....	
RATE.—HUNTINGTON .....	*82, *98	—Stretching, Catheterization after..	400	—IN RELATION TO MEDICAL SCHOOLS	
				AND HOSPITALS.—HERB. ....	*50



	PAGE
—In War Surgery .....	*28, *66
—LOCAL; IMPROVEMENT IN THE VARIOUS METHODS, FOR EXTENSIVE ABDOMINAL OPERATIONS.—FINSTERER. ....	205
—Problem of .....	250
—Technic .....	250
—NITROUS OXID-OXYGEN AND MINIMUM ETHER; PROLONGED, FOR NEUROLOGICAL OPERATIONS: CASE REPORTS.—WARNER. ....	*70
—PRELIMINARY REPORT OF AN INVESTIGATION INTO THE OXYGEN PERCENTAGES OF.—WOOD AND BOTSFORD. ....	*117
—THE PROLONGED ORAL ADMINISTRATION IN NEUROLOGICAL OPERATIONS.—TONG. ....	*67
—STUDIES IN ITS EFFECTS ON ANIMALS INFECTED WITH TUBERCULOSIS THROUGH THE RESPIRATORY TRACT.—ROGERS. ....	*44
—NITROUS OXID-OXYGEN-ANESTHOL-PARALDEHYDE ANESTHESIA.—BIDDLE. ....	*105
—Ohio State Medical Association's Policy on.—W. Teachnor. ....	*125
—THE PSYCHOLOGY OF MUSIC IN RELATION TO.—GATEWOOD. ....	*47
—Regional .....	75
—Singularly Honored. ....	*91
—SURGICAL, AMONG BRITISH TROOPS IN THE TROPICS (INDIA)—ROUTH. ....	*66
—SYNERGISTIC, FOR DENTAL SURGERY.—ECKER. ....	*54
ANESTHETIC FOR INTRAORAL SURGERY, SELECTION OF THE.—BURMEISTER. ....	*75
—Service, Grant Hospital, Columbus, Passes New Rules for. ....	*124
—Situation, Currents in the Present. ....	*124
ANESTHETICS, EFFECTS ON THE CELLS.—MCCLENDON. ....	*104
—GENERAL; AN EXPLANATION FOR THE ANTAGONISTIC ACTION OF A SUBSTANCE SUCH AS CAFFEIN, TO THE ACTION OF.—BURGE. ....	*76
Anesthetist, Expert Medical and Dental; Who Benefits by the Safety Factor of the. ....	*59
—RELATIONS OF SURGEON AND.—LAHEY. ....	*107
Anesthetists; Canadian, Interstate and New York State; Joint Meeting. ....	98
—Drugless Cults and Optometrists; New (Kentucky) Practice Law for. ....	*26
—Meetings During 1921 .....	*60
—The Steps to Annihilation. ....	*27
Angina, Ludwig's. ....	46
—Pectoris, Surgical Treatment. ....	202
ANOXEMIA, THE THERAPEUTIC USE OF OXYGEN IN RELATION TO.—RUDOLF. ....	*114
APPENDICITIS, CHRONIC; CERTAIN PROTEAN MANIFESTATIONS OF.—SKILLERN. ....	189
—Mortality in. ....	203
ARONSTAM, N. E.—MEATOTOMY —ITS INDICATIONS AND TECHNIC. ....	60
ARTERY, COMMON FEMORAL; LIGATION, WITH REPORT OF A SUCCESSFUL CASE.—ELLARS. ....	214
Arthritis, Infective. ....	250
ARTHRODYSIS FOR LOSS OF HEAD AND NECK OF FEMUR. A CASE REPORT. MCGUIRE. ....	300
—Sacroiliac Joint. ....	314
Article, Medical; How to Prepare a. ....	67
Asphyxia, Surgical Aspects of. ..	74

	PAGE
Astragalus, Rotation-Dislocation. ....	73
AXTELL, WILLIAM H.—SEPARATION OF RECTI MUSCLES OF THE ABDOMEN A CAUSATIVE FACTOR IN THE PRODUCTION OF PTOSIS OF COLON AND SIGMOID AND FECAL STASIS. ....	401
B	
BARRIE, GEORGE.—HEMORRHAGIC OSTEOMYELITIS (GIANT-CELL SARCOMA, GIANT-CELL TUMOR.) .....	253
BASKERVILLE, CHARLES and M. HIRSCH.—ON THE RATE OF EVAPORATION OF ETHYL CHLORID FROM OILS. ....	*52
BEACH, EDWARD W.—ANESTHESIA FOR OPERATIONS ON CHILDREN. ....	*71
BENMOSCHE, M.—A PLEA FOR PRE-SURGICAL DIAGNOSTIC ACCURACY. ....	352
BIDDLE, A. GRAHAM.—REMOVAL OF TONSILS AND ADENOIDS UNDER NITROUS OXID-OXYGEN-ANESTHOL-PARALDEHYDE ANESTHESIA. ....	*105
Bile Tract Disease, The Meltzer-Lyon Test of. ....	216
BLAIR, VILRAY PAPIN.—THE ANESTHESIA PROBLEM IN GOITER SURGERY FROM THE SURGEON'S VIEWPOINT. ....	*5
BLAKE, JOSEPH A.—THE TREATMENT OF FRACTURES OF THE HUMERUS BY SUSPENSION AND TRACTION. ....	97
BLANCHARD, WALLACE.—BOW-LEGS AND OTHER RACHITIC DEFORMITIES. ....	264
Bleeding from the Rectum. ....	406
BLOOD PRESSURE GUIDES DURING ANESTHESIA AND OPERATION.—MILLER. ....	*34
BLOOM, GEORGE H.—See REIMANN, S. P. AND OTHERS. ....	*77
BOOK REVIEWS:	
Albee, F. H.—Orthopedic and Reconstruction Surgery. ....	75
American Year Book of Anesthesia and Analgesia. ....	80
Ames, F., Jr.—American Red Cross Work Among the French People. ....	80
Anders, J. M.—A Text Book of the Practice of Medicine. 14th Edition. ....	80
Ashhurst, A. P. C.—Surgery. Its Principles and Practice. 2nd Edition. ....	76
Atkinson, D. T.—A Treatise on Cataract. ....	364
Bandler, S. W.—The Endocrines. ....	95
Barton, G. A. H.—Backwaters of Lethé. ....	*22
Bassler, A.—Diseases of the Intestines and Lower Alimentary Tract. ....	316
Bowlby, Sir A. A., and Sir F. W. Andrewes.—Surgical Pathology and Morbid Anatomy. 7th Edition. ....	47
Braun, H.—Die Örtliche Betäubung. 6th Edition. ....	316
Broca, A.—Chirurgie de Guerre et d'Après-guerre. ....	218
Brown, W. L.—The Sympathetic Nervous System in Disease. ....	172
Burghard, F. F., and A. B. Kanavel.—Oxford Loose-Leaf Surgery. Volume 1; Supplement. ....	*62

	PAGE
Buxton, D. W.—Anesthetics; Their Uses and Administration. 6th Edition. ....	*62
Carman, R. D.—The Roentgen Diagnosis of Diseases of the Alimentary Canal. 2nd Edition. ....	80
Choulant, L.—History and Bibliography of Anatomic Illustrations. ....	171
Christian and Mackenzie, Editors.—The Oxford Medicine. V. 2, 4. ....	96, 219, 364
Comyns, B., and V. Bonney.—The Difficulties and Emergencies of Obstetric Practice. 3rd Edition. ....	47
Croonian Lectures. See Hurst, A. F. ....	172
Crossen, H. S.—Operative Gynecology. 2nd Edition. ....	204
Darier, J.—Dermatology. Edited by S. Pollitzer. ....	220
Deaver, J. B., and A. P. C. Ashhurst.—Surgery of the Upper Abdomen. 2nd Edition. ....	218
Doederlein —Kroenig Operative Gynaekologie. 4th Edition. ....	171
Dorland, W. A. N.—American Illustrated Medical Dictionary. 10th Edition. ....	204
Elliott, R. H.—Tropical Ophthalmology. ....	79
Flagg, P. J.—The Art of Anesthesia. 2nd Edition. ....	*92
Frazer, J. E.—The Anatomy of the Human Skeleton. 2nd Edition. ....	47
Gask, G. E., Editor.—Surgery. A Text-Book. ....	76
Gillies, H. D.—Plastic Surgery of the Face. ....	203
Gordon, A.—French-English Medical Dictionary. ....	47
Hare and Appleman.—Progressive Medicine. Vol. 1-2, 1921. ....	219, 364
Head, H., and Others.—Studies in Neurology. ....	79
Hertzler, A. F.—Clinical Surgery by Case Histories. 2 Volumes. ....	218
Highman, W. J.—Dermatology. ....	220
Holmes, G. W., and H. E. Rugles.—Roentgen Interpretation. 2nd Edition. ....	204
Horner, Sir T. C.—Medical Notes. ....	252
Horsley, J. S.—Operative Surgery. ....	331
Humphries, F. H.—Electro-Therapeutics for Practitioners. 2nd Edition. ....	204
Hurst, A. F.—Psychology of the Special Senses and Their Functional Disorders (Croonian Lectures). ....	172
International Journal of Gastroenterology. Vol. 1, No. 1. ....	252
Jansen, M.—Feebleness of Growth and Congenital Dwarfism. ....	220
Jansen, M.—On Bone Formation. ....	316
Jeanbrau, E., and Others.—Chirurgie Reparatrice et Orthopedique. ....	76
Jones, Sir R.—Injuries to Joints. 2nd Edition. ....	316
Jones, Sir R., Editor.—Orthopedic Surgery of Injuries. 2 Volumes. ....	217
Kanavel, A. B.—Infections of the Hand. A Guide to the Surgical Treatment. ....	332
Keen, W. W., Editor.—Surgery; Its Principles and Practice. Vol. 7-8. ....	251
Kisch, E.—Diagnostik und Therapie der Knochen- und Gelenktuberkulose. ....	219



	PAGE
Llewellyn, J. L.—Pensions and the Principles of Their Evaluation.	14
Luke, T. D.—Anesthesia in Dental Surgery. 4th Edition.	31
MacArthur, John.—Mental Hospital Manual.	364
Mayo Clinic, Rochester, Minn.—Collected Papers. Volume XI, 1919.	15
Miller, H. C.—Functional Nerve Diseases. An Epitomy of War Experience.	220
Moorhead, J. J.—Traumatic Surgery. 2nd Edition.	170
Morelli, E.—The Treatment of Wounds of Lung and Pleura. Translated by L. Davis, and F. C. Irving.	77
Moynihan, Sir B.—Essays on Surgical Subjects.	363
Much, H.—Tuberculosis of Children.	219
Myers, V. C.—Practical Chemical Analysis of Blood.	364
Oxford Loose-Leaf Surgery.—See Burghard and Kanavel.	*63
The Oxford Medicine, by Various Authors.—See Christian and Mackenzie.	96
Pitzman, M.—The Fundamentals of Human Anatomy.	14
Porter, W. H.—Eating to Live Long.	47
Progressive Medicine.—See Hare and Appleman.	219
Ramsey, A. M.—Clinical Ophthalmology for the General Practitioner.	79
Roberts, J. B., and J. A. Kelly.—Treatise on Fractures. 2nd Edition.	218
Roth, P. B.—Orthopedics for Practitioners.	48
Ryan, T. J.—Teeth and Health.	172
Sauerbruch, F.—Die Chirurgie der Brustorgane.	77
Sewall, M. W.—Neither Dead nor Sleeping.	15
Sharpe, W.—Diagnosis and Treatment of Brain Injuries.	95
Sherwood-Dunn.—Regional Anesthesia: Victor Pauchet's Technique.	*127
Singer, C.—Studies in the History and Method of Science. Vol. 2.	251
Skillern, R. H.—The Accessory Sinuses of the Nose. 3rd Edition.	15
Skillman, G. R.—Stammering; Its Cause and Cure.	80
Smith, A. E.—Block Anesthesia and Allied Subjects.	*62
Soutar, H. S., and E. W. Twining.—Injuries of the Peripheral Nerves.	78
Stengel, A.—A Text-Book of Pathology. 7th Edition.	316
Stewart, F. T.—A Manual of Surgery. 5th Edition.	170
Stillman, J. M.—Theophrastus Bombastus von Hohenheim, called Paracelsus.	171
Surgical Clinics of North America. Vol. I, No. 1-2, 4.	252, 364
Voelcker, and Others.—Urologische Operationslehre.	75
Whitman, R.—Orthopedic Surgery. 6th Edition.	170
BONE GRAFTS. See DELAGENIÈRE.	281

	PAGE
—Surgery, Discussion; British Medical Association.	312
BOTSFORD, MARY E. — See WOOD, DOROTHY A.	*117
BOW-LEGS AND OTHER RACHITIC DEFORMITIES.—BLANCHARD.	264
BRAIN INJURIES, WITH OR WITHOUT SKULL FRACTURE. See W. SHARPE.	147
Bronchoscopy in Diagnosis of Mediastinal Tumors.	202
Bullet Energy, Dispersal of, in Relation to Wound Effects.	362
BURGE, WILLIAM E.—AN EXPLANATION FOR THE ANTAGONISTIC ACTION OF A SUBSTANCE SUCH AS CAFFEIN, TO THE ACTION OF GENERAL ANESTHETICS.	*76
BURMEISTER, C. H.—THE SELECTION OF THE ANESTHETIC FOR INTRAORAL SURGERY.	*75
Bursitis, Retrocalcaneal.	315
<b>C</b>	
CAFFEIN AND ANESTHETICS. See BURGE.	*76
CALCULI, URETERAL; DIFFICULTIES IN THE DIAGNOSIS OF.—HAMMER.	348
Cancer	363
—Bladder	84
—Breast	248
—Cervix	201, 248
—Prostate,	41
—Tonsil	215
—Uterus	249
—Radiotherapy in.	39
—Radium Therapy.	42, 249
—Research.	133
—Rectal.	406
—SOME FACTS REGARDING.—SALTZSTEIN.	81
—Stasis and Preveniton.	42
—Treatment	248
—Week.	329
—X-RAYS IN 79 CASES. See McCoy.	185
—See also Carcinoma.	
CARCINOMA OF THE BONE, RADIUM TREATMENT.—NEILL.	32
—See also Cancer.	
CARP, LOUIS.—SOME PHASES OF LEG ULCER.	180
Cataract Operations by the Smith-Indian-Fisher Method, Fifty Consecutive.	251
CATES, BENJAMIN BRABSON.—AN OPERATION FOR VESICO-VAGINAL FISTULA: A CASE REPORT.	196
Cesarean Section, Repeated.	248
—Twenty-one Years' Experience with.	247
CHEST INJURIES, A CONSIDERATION OF ONE HUNDRED AND NINETY.—SHIPLEY.	221
Colon, Ascending; Fixation of.	201
CONTRACTURES FOLLOWING WAR WOUNDS, CLINICAL AND THERAPEUTICAL REMARKS ON.—LÉREL.	275
COTTON FREDERIC J.—TREATMENT OF ANKLE FRACTURES.	138
COUES, WILLIAM PEARCE.—SOME MANIFESTATIONS OF SYPHILIS OF INTEREST TO SURGEONS.	193
CRANCE, ALBERT M.—EXOPHTHALMIC GOITER IN A GIRL OF SIXTEEN, WITH SPECIAL REFERENCE TO ETIOLOGY AND END-RESULTS FOLLOWING LIGATION WITHOUT THYROIDECTOMY.	9

	PAGE
CRILE, G. W., AND OTHERS.—CERTAIN POST-OPERATIVE COMPLICATIONS OF OPERATIONS ON THE THYROID GLAND.	317
CROSS, CHARLES.—ARTIFICIAL TOES.	306
CROTTI, ANDRÉ.—THE ANESTHESIA PROBLEM IN GOITER SURGERY—GENERAL CONSIDERATIONS.	*2
CYST, ATHERMATOUS (DERMOID) OF THE UMBILICUS, A CASE OF CONGENITAL.—SMITH.	327
<b>D</b>	
DAVIS, S. GRIFFITH.—A DROP METHOD OF ETHER VAPOR ANESTHESIA AND APPARATUS FOR ITS ADMINISTRATION.—DAVIS.	*37
DEAVOR, T. L.—FULL TERM ABDOMINAL PREGNANCY: REPORT OF A CASE.	213
DECOURCY, JOSEPH L.—RESULTS FOLLOWING 245 THYROIDECTOMIES.	342
Deformities, Foot and Ankle; Reconstructive Surgery.	313
DELAGENIÈRE, HENRI.—REPAIR OF LOSS OF BONY SUBSTANCE AND RECONSTRUCTION OF BONES BY OSTEOPERIOSTEAL GRAFTS TAKEN FROM THE TIBIA. (WITH 118 NEW PERSONAL CASES.)	281
DIAGNOSTIC ACCURACY, A PLEA FOR PRE-SURRICAL.—BENMOSCHE.	352
DIATHERMY, SURGICAL.—KOLISCHER.	177
DISLOCATION, CENTRAL, OF HIP, WITH REPORT OF THREE CASES.—PALMER.	118
—Of Shoulder, Recurring.	170
—Of Foot, Irreducible.	170
DRUECK, CHARLES J.—COMPLETE PROLAPSE OF THE RECTUM.	208
—RADICAL CURE OF HEMORRHOIDS.	85
DUNNING, W. MEDDAUGH.—THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM.	I, 34, 63
DUODENAL HEMORRHAGE DANGEROUS TO LIFE, OPERATIVE TREATMENT OF ACUTE.—FINSTERER.	319
Dying, Phantasies of the.	362
<b>E</b>	
Ear, Sea Bathing and the.	250
—Drum, Relaxed.	66
EARLY, C. E.—THE TREATMENT OF FEMUR FRACTURES.	302
ECKER, M.—SYNERGISTIC ANESTHESIA FOR DENTAL SURGERY.	*54
<b>EDITORIALS:</b>	
Actinomycosis	197
Acute Anatomy	67
Anesthesia Singularly Honored.	*91
A Bust of Morton for the Hall of Fame	*91
Bleeding from the Rectum.	406
Cancer Week	329
The Curability of Bone Sarcomas.	94
Currents in the Present Anesthetic Situation	*124
Developments in Intrathoracic Surgery.	93
Dwight H. Murray.	407
The Election of Morton, Anesthetist, to the Hall of Fame.	*59
Fads in Medicine and Surgery.	358
Fractures.	165
Grant Hospital, Columbus, Passes New Rules for Anesthetic Service.	*124
How to Prepare a Medical Article.	67



	PAGE
In Memoriam, Samuel James Meltzer.....	*60
The Meltzer-Lyon Test of Bile Tract Disease.....	216
New (Kentucky) Practice Law for Anesthetists, Drugless Cults and Optometrists.....	*26
An Operation to Effect Cure of Ischio-Rectal Abscess.....	406
Orthopedic Surgery.....	309
Plastic and Cosmetic Surgery of the Face and Neck.....	199
Radiotherapy in Cancer.....	39
Results of Secondary Peripheral Nerve Suture.....	13
Rectal Cancer.....	406
The Steps to Annihilation.....	*27
Surgical Fees.....	310
The Surgical Treatment of Acute Pelvic Infections in Women.....	328
Syphilis and Sarcoma of the Bone.....	246
Submucous Resection of the Nasal Septum.....	14
Wallace C. Abbott. (Obituary).....	247
Who Benefits by the Safety Factor of the Expert Medical and Dental Anesthetist.....	*59
ELLARS, L. R.—LIGATION OF THE COMMON FEMORAL ARTERY; WITH REPORT OF A SUCCESSFUL CASE.....	214
ELY, LEONARD W.—THE TREATMENT OF JOINT TUBERCULOSIS.....	261
Empyema, Pleural.....	47
Epithelioma, Squamous-Cell.....	73
ESTES, W. L.—POTT'S FRACTURE OF THE FIBULA, OR FRACTURE-DISLOCATION AT THE ANKLE.....	142
ETHER, INTRATRACHEAL INSUFFLATION, IN OPERATIONS WHICH INVOLVE BLEEDING INTO THE AIR PASSAGES.—SHIPWAY.....	*16
—VAPOR ANESTHESIA, A DROP METHOD, AND APPARATUS FOR ITS ADMINISTRATION.—DAVIS.....	*37
ETHYL CHLORID-OIL, ON THE RATE OF EVAPORATION.—BASKERVILLE AND HIRSCH.....	*52

## F

Fads in Medicine and Surgery.....	358
Fascia Lata, Surgical Uses of.....	202
Fees, Surgical.....	310
FINSTERER, HANS.—IMPROVEMENT IN THE VARIOUS METHODS OF LOCAL ANESTHESIA FOR EXTENSIVE ABDOMINAL OPERATIONS.....	205
—OPERATIVE TREATMENT OF ACUTE DUODENAL HEMORRHAGES DANGEROUS TO LIFE.....	319
FISTULA IN ANO, TUBERCULOSIS AND. See GANT.....	368
—VESICO-VAGINAL; AN OPERATION FOR.—CATES.....	196
FISTULAE, RECTAL; A CLASSIFICATION OF, WITH TREATMENT OF EACH VARIETY.—PENNINGTON.....	372
—PRESERVATION OF THE ANAL MUSCLES IN OPERATIONS FOR.—HANES.....	373
Foot, Flat.....	308
—Human; Mechanism in Walking.....	313
FORCEPS, SPECIMEN; BIOPSY OF INTESTINAL TUMORS AND A NEW.—YEOMANS.....	376
FRACTURE, FIBULA; POTT'S FRACTURE, OR FRACTURE-DISLOCATION AT THE ANKLE.—ESTES.....	142
—Number (Notice).....	94
—SUGGESTIONS.....	166, 188, 261, 295

	PAGE
Fractures.....	165
—ANKLE; TREATMENT OF.—COTTON.....	138
—Arm; Volkmann's Contracture.....	164
—Bone Tenderness in.....	133
—Carpal Scaphoid.....	329
—Cervical Vertebrae, with Cord Injury.....	331
—Elbow.....	248
—Examination for, in Children.....	100
—Femur; Hodgen Splint in.....	169
—INTERTROCHANTERIC (PERITROCHANTERIC).—SPEED.....	123
—Simple Extension Method.....	169
—THE TREATMENT OF.—EARLY.....	302
—FEMUR NECK; FIXATION BY A WOOD SCREW WITHOUT ARTHROTOMY IN CERTAIN.—THOMAS.....	292
—FINGERS AND TOES.—MOCK.....	109
—Forearm, in Children.....	313
—HIP; THE WHITMAN ABDUCTION METHOD IN THE TREATMENT OF.—PIRTLE.....	122
—HUMERUS; TREATMENT BY SUSPENSION AND TRACTION.—BLAKE.....	97
—IMMOBILIZATION, EARLY AND COMPLETE, AS A FACTOR IN THE PRESERVATION OF JOINT FUNCTION IN THE TREATMENT OF.—ORR.....	146
—LEG; STANDARDIZED TREATMENT OF.—MOORHEAD.....	133
—Os Calcis.....	330
—Radius, Base.....	168
—Head.....	141
—THE FACTORS THAT INFLUENCE PROGNOSIS.—HITZROT AND MURRAY.....	17
—HEAD AND NECK OF.—HITZROT.....	100
—And Ulna; Delayed- and Non-Union.....	168
—Reduction and Fixation with a Specially Devised Band.....	167
—ROENTGENOGRAPHY AT BEDSIDE.—HIRSCH.....	159
—Skull Defects, Bone Grafts in.....	169
—THE PATHOLOGY AND TREATMENT OF CHRONIC BRAIN INJURIES, WITH OR WITHOUT A FRACTURE OF THE SKULL.—W. SHARPE.....	147
—SPINE; THE CHIEF LESIONS FOLLOWING.—N. SHARPE.....	152
—Tibia and Fibula.....	361
—Treatment; Influence of the War on.....	167
—Vertebra, First Lumbar.....	160
—X-ray Pathology.....	168
FRANK, LOUIS.—INTUSSUSCEPTION OF THE COLON CAUSED BY ANATOMIC DEFECT. A CASE REPORT.....	12

## G

GALLIE, W. E.—THE IMPLANTATION OF TENDONS.....	268
GANT, SAMUEL G.—RELATION OF PULMONARY TUBERCULOSIS TO FISTULA IN ANO.....	368
GASTRECTOMY, A NEW OPERATIVE TECHNIC.—MARTEL.....	227
Gastric and Duodenal Ulcers, Radium Treatment.....	249
GASTRO-RECTO-ENTERIC SURGERY, THE PRINCIPLES OF.—MACMILLAN.....	394
Gastrostomy and Colostomy.....	245
GATEWOOD, ESTHER L.—THE PSYCHOLOGY OF MUSIC IN RELATION TO ANESTHESIA.....	*47
GIBBON, J. W. See GIBBON, R. L. GIBBON R. L., and J. W. GIBBON. THE SURGICAL SIGNIFICANCE OF VOMITING.....	335

	PAGE
GOITER, EXOPHTHALMIC, IN A GIRL OF SIXTEEN, WITH REFERENCE TO ETIOLOGY AND END-RESULTS FOLLOWING LIGATION WITHOUT THYROIDECTOMY.—CRANCE.....	9
—Operability.....	40
—OPERATIONS, THE VALUE OF ANOCIATION IN.—LOWER.....	*7
—Simple, in Man; Prevention of.....	362
—SURGERY, THE ANESTHESIA PROBLEM IN, FROM THE SURGEON'S VIEWPOINT.—BLAIR.....	*5
—THE ANESTHESIA PROBLEM IN GENERAL CONSIDERATIONS.—CROTTI.....	*2
—ETHER-OIL COLONIC ANESTHESIA IN.—LATHROP.....	*14
—Toxic; Radium in.....	41
—See also Hyperthyroidism, Thyroid Gland, Etc.	
GOLDSTEIN, ALBERT E.—PYELOGRAPHY AND URETEROGRAPHY IN DIFFERENTIAL DIAGNOSIS OF SURGICAL CONDITIONS.....	89
GOLDSTEIN, HYMAN I.—PRIMARY SARCOMA OF THE GALLBLADDER.....	351
—PRIMARY SARCOMA OF THE INTES-TINES. A REVIEW OF RECORDED CASES.....	240, 323
Grafts, Bone; Researches on.....	170
—OSTEOPERIOSTEAL, TAKEN FROM THE TIBIA; REPAIR OF LOSS OF BONY SUBSTANCE AND RECONSTRUCTION OF BONES BY. (WITH 118 NEW PERSONAL CASES)—DELAGENIERE.....	281
GRIGSBY, GUY P.—TRAUMATIC RUPTURE OF THE SPLEEN. REPORT OF A CASE.....	339
GROWTHS, MALIGNANT; A REPORT OF 79 CONSECUTIVE CASES TREATED WITH X-RAYS.—MCCOY.....	185
GUILFORD, S. DUDLEY.—ISCHIO-RECTAL ABSCESS: ITS ETIOLOGY, AND A METHOD OF TREATMENT TO AVOID FISTULA AND RECURRENCE.....	365
GWATHMEY, JAMES T.—THE ANESTHETIC PROBLEM IN LUNG SURGERY.....	*28
Gynastresia with Pregnancy.....	331

## H

HAMMER, A. WIESE.—DIFFICULTIES IN THE DIAGNOSIS OF URETERAL CALCULI.....	348
—PAINFUL AND DISABLED SHOULDERS.....	29
HANES, GRANVILLE S.—PRESERVATION OF THE ANAL MUSCLES IN OPERATION FOR RECTAL FISTULAE.....	373
HARRISON, B. I. See CRILE, G. W.....	317
HAWLEY, DONLY C.—HYPERTROPHY OF THE ANAL PAPILLAE.....	378
HEIDBRINK, J. A.—STANDARDIZATION OF NITROUS OXID-OXYGEN ANESTHESIA INDUCTION.....	*56
HEMORRHOIDS, QUININ AND UREA TREATMENT OF.—See TERRELL.....	382
—RADICAL CURE OF.—DRUECK.....	85
—Operative Treatment of.....	407
Hepatoduodenostomy, Case of.....	361
HERB, ISABELLA C.—ANESTHESIA IN RELATION TO MEDICAL SCHOOLS AND HOSPITALS.....	*50



	PAGE		PAGE		PAGE
HERMANCCE, W. OAKLEY.— THE CHOICE OF A GENERAL ANES- THETIC IN PROCTOLOGIC SURGERY...	385	JONES, SIR ROBERT.—TENDON TRANSPLANTATION, IN CASES OF MUSCULOSPIRAL INJURIES NOT AMENABLE TO SUTURE.	333	MAYER, LEO.—THE FREE TRANS- PLANTATION OF TENDONS. ....	271
Hernia, Recurrent. ....	203	JONES, W. I.—FURTHER STUDIES IN DETERMINING OXYGEN NEED DURING ANESTHESIA. ....	*109	MEATOTOMY—ITS INDICATIONS AND TECHNIC.—ARONSTAM. ....	60
HESTER, J. H.—FOCAL INFECTION, WITH ESPECIAL REFERENCE TO THE TONSIL. ....	346	K		MECHLING, CURTIS C.—TUBER- CULOMA OF THE ISCHIO-RECTAL FOSSA. ....	371
Hip Disease, Old. ....	43	KELSALL, OLIVER H.—VARI- COSE VEINS OF THE BROAD LIGA- MENT: OR VARIX OF THE FEMALE PAMPINIFORM PLEXUS. ....	8	Meltzer, Samuel James. In Memor- iam. ....	*60
HIRSCH, I. SETH.—THE BEDSIDE ROENTGENOGRAPHY OF FRACTURES.	159	KENNEDY, J. W.—HAS THE RUB- BER GLOVE SOLVED THE QUESTION OF HAND INFECTION?.....	61	Mercurochrome as a Germicide....	249
HIRSCH, MYRON. See BASKER- VILLE.		KLEINBERG, S.—THE INJECTION OF OXYGEN INTO JOINTS FOR DIAG- NOSIS. ....	256	Mid-Western Association of Anes- thetists, Organization of, Kansas City. ....	*92, *126
HIRSCH, T. W. — DOSIMETRIC CHLOROFORM AND ETHER VAPOR ANESTHESIA: SOME REFLECTIONS OF A SICK ANESTHETIST. ....	*23	Knee, Resection of. ....	361	MIERS, E. M.—PRE-OPERATIVE, OPERATIVE, AND POST-OPERATIVE CARE OF THE PATIENT.....	223
HITZROT, JAMES MORLEY.— FRACTURES OF THE HEAD AND THE NECK OF THE RADIUS. ....	100	—SURGERY OF THE: MENISCI, CRU- CIAL LIGAMENTS, AND ARTICULAR CARTILAGES.—ROUX-BERGER. ....	54	MILLER, ALBERT H.—BLOOD PRESSURE GUIDES DURING ANES- THESIA AND OPERATION.....	*34
—And C. R. MURRAY.—THE FAC- TORS THAT INFLUENCE THE PROG- NOSIS IN FRACTURES AT THE BASE OF THE RADIUS. ....	17	KOLISCHER, GUSTAV.—SUR- GICAL DIATHERMY. ....	177	MOCK, HARRY E.—FRACTURES OF THE FINGERS AND TOES. ....	109
HUNT, H. LYONS, Editor. See....		KULLY, BARNEY M.—PULMON- ARY SUPPURATION—ITS DIRECT TREATMENT THROUGH THE BRON- CHOSCOPE. ....	50	Mole, Hydatidiform, Chorio-Epitheli- oma, and Ovarian Cysts. ....	363
—See TIECK, G. J. E., and H. L. HUNT. ....	173	L		MOORHEAD, JOHN J.—STAND- ARDIZED TREATMENT OF FRACT- TURES OF THE LEG. ....	133
HUNTINGTON, ELLSWORTH. —AIR-CONTROL AS A MEANS OF REDUCING THE POST-OPERATIVE DEATH RATE. ....	*82, *98	Labor Induction by Rupture of Membranes and Quinine. ....	331	Morton, William T. C., Anesthetist; His Election to the Hall of Fame...*	59
Hydrocephalus. ....	73	LAHEY, FRANK.—RELATIONS OF SURGEON, AND ANESTHETIST. ....	*107	—Bust for the Hall of Fame.....	*91
HYDROTHERAPY, RECTO-COLONIC.— ZOBEL. ....	403	LATHROP, WALTER.—ETHER- OIL COLONIC ANESTHESIA IN GOI- TER SURGERY. ....	*14	MURRAY, CLAY RAY. See HITZ- ROT, J. R., and C. R. MURRAY....	17
HYPERTHYROIDISM, CLINICAL OBSER- VATIONS ON 100 NITROUS OXID- OXYGEN ANESTHESIAS IN CASES OF.—SISE. ....	*9	LEG ULCER, SOME PHASES OF.— CARP. ....	180	Murray, Dwight H. ....	407
—Roentgen-ray Therapy. ....	75	LÉRI, ANDRÉ.—CLINICAL AND THERAPEUTICAL REMARKS ON CON- TRACTURES FOLLOWING WAR WOUNDS. ....	275	MUSCULOSPIRAL INJURIES, TENDON TRANSPLANTATION IN CASES NOT AMENABLE TO SUTURE.—SIR R. JONES. ....	333
—See Also Goiter, Thyroid Gland, Etc.		Liver, Abscess; Amebic. ....	45	MUSIC AND ANESTHESIA.—GATE- WOOD. ....	*47
I		—Cirrhosis; Cure of. ....	74	N	
IMPLANTATION OF TENDONS. See		LOWER, W. E.—THE VALUE OF ANOCIATION IN GOITER OPERA- TIONS. ....	*7	Nasal Septum, Submucous Resection of the. ....	14
GALLIE. ....	268	—See CRILE, G. W. ....	317	— —THE SUBMUCOUS RESECTION OF THE.—DUNNING. ....	I, 34, 63
Impregnation, Artificial. ....	45	Lung Abscess. ....	223	NEILL, WILLIAM, JR.—RADIUM IN THE TREATMENT OF SARCOMA AND CARCINOMA OF THE BONE...*	32
INFECTION, FOCAL, WITH ESPECIAL REFERENCE TO THE TONSIL.—HES- TER. ....	346	—SURGERY, THE ANESTHETIC PROB- LEM IN.—GWATHMEY. ....	*28	Nephro-Ureterectomy, Aseptic. ....	362
—HAND; HAS THE RUBBER GLOVE SOLVED THE QUESTION OF?—KEN- NEDY. ....	61	M		Nerve Function, Testing. ....	301
Infections, Pelvic, in Women; The Surgical Treatment of Acute. ..	328	McCLENDON, J. F.—EFFECTS OF ANESTHETICS ON THE CELLS. ....	*104	—Injuries, Indications for Explora- tions of. ....	200
Interstate Association of Anesthet- ists; Annual Meetings .....*	*31, *61	MCCOY, JAMES N.—A REPORT OF 79 CONSECUTIVE CASES OF MALIG- NANT GROWTHS TREATED WITH X-RAYS. ....	185	—Suture, Peripheral; Results of Secondary. ....	13
INTESTINAL TUMORS, BIOPSY OF. See YEOMANS. ....	376	MCGUIRE, FRANCIS W.—ARTH- RODESIS FOR LOSS OF HEAD AND NECK OF FEMUR. A CASE REPORT.*	300	NITROUS OXID SATURATION, PRI- MARY AND SECONDARY AS A TEST FOR DETERMINING THE CAPACITY OF THE PATIENT FOR OPERATION.— McKESSON. ....	*43
INTESTINES, PRIMARY SARCOMA.— GOLDSTEIN. ....	240	MCKENNEY, DESCUM C.—POST- OPERATIVE COMFORT IN RECTAL CASES. ....	391	—OXID-OXYGEN ANESTHESIA IN- DUCTION, STANDARDIZATION OF.— HEIDBRINK. ....	*56
Intrathoracic Surgery, Developments in. ....	93	McKESSON, E. I.—PRIMARY AND SECONDARY NITROUS OXID SAT- URATION AS A TEST FOR DETER- MINING THE CAPACITY OF THE PA- TIENT FOR OPERATION. ....	*43	NOVITZKY, JOSEF.—EXTERNAL ALVEOLECTOMY (Letter to Editor.)	66
INTUSSUSCEPTION OF THE COLON CAUSED BY ANATOMIC DEFECT. A CASE REPORT.—L. FRANK. ....	12	MACMILLAN, JAMES A.—THE PRINCIPLES OF GASTRO-RECTO-EN- TERIC SURGERY. ....	394	Nurses, American; The Toll in the War. ....	66
ISCHIO-RECTAL ABSCESS: ITS ETI- OLOGY, AND A METHOD OF TREAT- MENT TO AVOID FISTULA AND RE- CURRENCE.—DUDLEY. ....	365	MARTEL, T. DE.—GASTRECTOMY. NEW OPERATIVE TECHNIC. ....	227	—As Anesthetists. ....	*125
—An Operation to Effect Cure of...	406	MARTIN, COLLIER F.—POST- GRADUATE TEACHING OF PROC- TOLOGY. ....	398	O	
J		Mastoiditis. ....	46	O'DAY, J. CHRISTOPHER.— THE RELATION OF PYLORIC RE- SISTANCE TO THE RECURRENCE OF STOMACH ULCERS. ....	354
Joint Function, Restoration. ....	33			OPERATIVE RISK, TEST FOR. See McKESSON. ....	*43
Joints, Air Injection Into, and De- rangements of Semilunar Carti- lages ....	170			Orbit, Operations. ....	94
—Stiff; Manipulation of. ....	314			ORR, H. WINNETT.—EARLY AND COMPLETE IMMOBILIZATION AS A FACTOR IN THE PRESERVATION OF JOINT FUNCTION IN THE TREAT- MENT OF FRACTURES. ....	146



	PAGE
OSTEO-ARTHRITIS OF HIP, OPERATIVE TREATMENT (ARTHRODESIS) FOR ALBEE. ....	296
Osteomyelitis, Fibula. ....	295
—HEMORRHAGIC (GIANT-CELL SARCOMA, GIANT-CELL TUMOR).—BARRIE. ....	253
—Sclerosing Non-Suppurative. ....	361
<i>Orthopedic Issue (Notice)</i> . ....	246
OXYGEN, INJECTION INTO JOINTS FOR DIAGNOSIS.—KLEINBERG. ....	256
—NEED, FURTHER STUDIES IN DETERMINING.—W. I. JONES. ....	*109

## P

Palate, Cleft; Surgical Treatment of, and Its Mechanical Counterpart. ....	200
PALMER, DUDLEY WHITE.—CENTRAL DISLOCATION OF THE HIP, WITH REPORT OF THREE CASES... 118	
PALSEY, ERB'S; THE OPERATIVE CORRECTION OF LONG STANDING.—SEVER. ....	287
Papilloma, Vesical. ....	92
PATIENT, PRE-OPERATIVE, AND POST-OPERATIVE CARE OF THE.—MIERS. ....	223
PEEBLES, A. E.—CHARTING THE SIGNS AND SYMPTOMS OF ANESTHESIA FOR TEACHING PURPOSES.*100	
PENNINGTON, J. RAWSON.—A CLASSIFICATION OF RECTAL FISTULAE: TREATMENT OF EACH VARIETY. ....	372
PIRTLE, ROBERT T.—THE WHITMAN ABDUCTION METHOD IN THE TREATMENT OF HIP FRACTURE. ....	122
PREGNANCY, ABDOMINAL; FULL TERM: REPORT OF A CASE.—DEAVOR. ....	213
—With Gynastresia. ....	331
—Torsion of Fallopian Tube in... 363	
Proctitis, Acute. ....	402
PROCTOLOGIC SUGGESTIONS: ....	384, 200, 405
PROCTOLOGIC SURGERY, THE CHOICE OF A GENERAL ANESTHETIC IN.—HERMAN. ....	385
PROCTOLOGY, POST-GRADUATE TEACHING OF.—MARTIN. ....	398
PROGRESS IN SURGERY (Dept.) 40, 73, 167, 200, 247, 311, 329, 360	
PROSTATE, SARCOMA OF THE.—STERN AND RITTER. ....	238
Prostatectomy. ....	45
PRURITIS ANI, ITS TREATMENT BY IONIC MEDICATION.—ROLFE.....	387
PULMONARY SUPPURATION—ITS DIRECT TREATMENT THROUGH THE BRONCHOSCOPE.—KULLY. ....	50
PYELOGRAPHY AND URETEROGRAPHY IN DIFFERENTIAL DIAGNOSIS OF SURGICAL CONDITIONS.—A. E. GOLDSTEIN. ....	89

## Q

QUARTERLY INDEX. *32, *63, *94, *127	
QUININ AND UREA IN THE TREATMENT OF INTERNAL HEMORRHOIDS, MY PRESENT VIEWS OF.—TERRELL. ....	382

## R

RACHITIC DEFORMITIES, BOW-LEGS AND OTHER.—BLANCHARD. ....	264
Radiotherapy in Cancer. ....	39
Radium and Roentgen Rays in Mal-ignancy. ....	201
—IN THE TREATMENT OF SARCOMA AND CARCINOMA OF THE BONE.—NEILL. ....	32

Radium's Place in Therapy.....	200
RECTAL CASES, POST-OPERATIVE COMFORT IN.—MCKENNEY. ....	391
RECTI MUSCLES, SEPARATION OF, AS A CAUSATIVE FACTOR IN THE PRODUCTION OF PTOSIS OF COLON AND SIGMOID AND FECAL STASIS.—AXTELL. ....	401
<i>Rectum, Bleeding from the</i> . ....	406
RECTUM, BLEEDING FROM THE; ITS SIGNIFICANCE AND TREATMENT.—SAPHIR. ....	379
—Cancer of the. ....	407
—Procidencia of the. ....	408
—PROLAPSE; COMPLETE.—DRUECK... 208	
REIMANN, HOBART A. See REIMANN, STANLEY P., AND OTHERS. ....	*77
REIMANN, STANLEY P.—AND OTHERS.—ADMINISTRATION OF CARBON DIOXID AFTER ANESTHESIA AND OPERATION. ....	*77
Rhabdomyoma of the Nose. ....	46
Rib Pressure and the Brachial Plexus. ....	311
RITTER, I. SIDNEY. See STERN, AND I. S. RITTER. ....	238
ROGERS, J. B.—STUDIES IN THE EFFECTS OF NITROUS OXID-OXYGEN ANESTHESIA ON ANIMALS INFECTED WITH TUBERCULOSIS THROUGH THE RESPIRATORY TRACT. ....	*44
ROLFE, WILLIAM A.—THE TREATMENT OF PRURITIS ANI BY IONIC MEDICATION. ....	387
ROSS, EDITH MCKAY.—SOME OBSERVATIONS ON THE OCCURRENCE OF ACIDOSIS FOLLOWING OPERATION. ....	*121
ROUTH, LAURENCE M.—SURGICAL ANESTHESIA AMONG BRITISH TROOPS IN THE TROPICS. (INDIA). ....	*66
ROUX-BERGER, J. L.—SURGERY OF THE KNEE: MENISCI, CRUCIAL LIGAMENTS, AND ARTICULAR CARTILAGES. ....	54
RUDOLF, ROBERT DAWSON.—THE THERAPEUTIC USE OF OXYGEN IN RELATION TO ANOXEMIA.*114	

## S

SAPHIR, J. F.—BLEEDING FROM THE RECTUM; ITS SIGNIFICANCE AND TREATMENT. ....	379
SALTZSTEIN, HARRY C.—SOME FACTS REGARDING CANCER. ....	81
SARCOMA, GIANT-CELL. See BARRIE. ....	253
—OF THE BONE, RADIUM TREATMENT. See NEILL. ....	32
—Of the Bone, Syphilis and. ....	246
—OF THE GALL-BLADDER, PRIMARY.—H. I. GOLDSTEIN. ....	351
—OF THE INTESTINES, PRIMARY. A REVIEW OF RECORDED CASES.—H. I. GOLDSTEIN. ....	240, 323
—OF THE PROSTATE. REPORT OF A CASE.—STERN AND RITTER.....	238
Sarcomas, Bone; The Curability of. Scholarships, Post-Graduate Medical. ....	94, 100
Scoliosis, Non-Operative Treatment. ....	313
SEVER, JAMES WARREN.—THE OPERATIVE CORRECTION OF LONG-STANDING ERB'S PALSY. ....	287
SHARPE, NORMAN.—THE CHIEF LESIONS FOLLOWING SPINAL FRACTURE. ....	152

S H A R P E, WILLIAM.—THE PATHOLOGY AND TREATMENT OF CHRONIC BRAIN INJURIES, WITH AND WITHOUT A FRACTURE OF THE SKULL. ....	147
SHIPLEY, ARTHUR M.—A CONSIDERATION OF ONE HUNDRED AND NINETY CHEST INJURIES... 221	
SHIPWAY, F. E.—INTRATRACHEAL INSUFFLATION OF ETHER IN OPERATIONS WHICH INVOLVE BLEEDING INTO THE AIR PASSAGES. ....	*16
Shoulder, Downward Subluxation of. ....	360
SHOULDERS, PAINFUL AND DISABLED.—HAMMER. ....	29
Singultus. ....	250
SISE, LINCOLN F.—CLINICAL OBSERVATIONS ON 100 NITROUS OXID-OXYGEN ANESTHESIAS IN CASES OF HYPERTHYROIDISM. ....	*9
SKILLERN, P. G.—CERTAIN PROTEAN MANIFESTATIONS OF CHRONIC APPENDICITIS. ....	189
Skull Defects, Bone Grafts in... 169	
[ <i>Slang, Medical and Surgical</i> ]. ....	67
SLOAN, H. C. See CRILE, G. W. ....	317
SMITH, E. DARGAN.—A CASE OF CONGENITAL ATHEROMATOUS (DERMOID) CYST OF THE UMBILICUS. ....	327
SOCIETY PROCEEDINGS: ....	*31, *61, *93, *126
SPEED, KELLOGG.—INTER-TROCHANTERIC (PERTROCHANTERIC) FRACTURE OF THE FEMUR.....	123
SPLEEN, TRAUMATIC RUPTURE OF THE.—GRIGSBY. ....	339
STERN, MAXIMILIAN.—and I. S. RITTER.—SARCOMA OF THE PROSTATE. REPORT OF A CASE....	238
STOMACH ULCERS, THE RELATION OF PYLORIC RESISTANCE TO THE RECURRENCE OF.—O'DAY.....	354
Suppuration, Intranasal; Treatment. ....	202
Surgery, Bone; Discussion. ....	312
—In Children (Announcement)....	329
—Influence of the Great War Upon. ....	44
—Orthopedic. ....	309
—Plastic and Cosmetic, of the Face and Neck. ....	199
— — — OF THE HEAD, NECK AND FACE.—TIECK AND HUNT. 173, 211, 234, 355	
—PRINCIPLES OF. See MACMILLAN. ....	394
SURGICAL SERVICES, MINOR; SOME NEEDED IMPROVEMENTS IN OUR.—WAINWRIGHT. ....	322
SURGICAL SUGGESTIONS: ....	14, 39, 72, 166, 199, 311
Syndrome, Retro-Parotid; Exceptional Case of. ....	202
Syphilis and Sarcoma of the Bone... 246	
—In Nose, Throat and Ear. ....	38
—SOME MANIFESTATIONS OF INTEREST TO SURGEONS.—COUES. ...	193

## T

TENDON TRANSPLANTATION. See MAYER. ....	271
TENDONS, IMPLANTATION OF.—GALLIE. ....	268
TERRELL, E. H.—MY PRESENT VIEWS OF QUININ AND UREA IN THE TREATMENT OF INTERNAL HEMORRHOIDS. ....	382
Tetanus, Acute. ....	43
Therapeutics, Physical, from the Surgical Standpoint. ....	202
THOMAS, T. TURNER.—FIXATION BY A WOOD SCREW WITHOUT ARTHROTOMY IN CERTAIN FRACTURES OF NECK AND FEMUR.....	292



	PAGE
Thyroglossal Duct, Cysts and Fistulae. ....	74
THYROID GLAND, CERTAIN POST-OPERATIVE COMPLICATIONS OF OPERATIONS ON THE.—CRILE AND OTHERS. ....	317
THYROIDECTOMIES, 245; RESULTS FOLLOWING.—DECOURCY. ....	342
THYROIDECTOMY UNDER LOCAL ANESTHESIA.—ALLEN. ....	*12
TIECK GUSTAV J. E. and H. L. HUNT.—PLASTIC AND COSMETIC SURGERY OF THE HEAD, NECK, AND FACE. Historical Review, 173; Keloid, 211; Correction of Nasal Deformities, 234; Wounds, 355.	
TOES, ARTIFICIAL.—CROSS. ....	306
TONG, GEORGE W.—THE PROLONGED ORAL ADMINISTRATION OF NITROUS OXID-OXYGEN IN NEUROLOGICAL OPERATIONS. ....	*67
Tonsil Operations and Hemorrhage. ....	363
Tonsillectomy, End-Results, 46; Lung Infections After ....	193
Transfusion, Blood. ....	43
TRANSPLANTATION OF TENDONS; THE FREE.—MAYER. ....	271
Transplantations, Bone. ....	315
Trochanter, Great; Differential Diagnosis in Destructive Lesions..	331
TUBERCULOMA OF THE ISCHIO-RECTAL FOSSA.—MECHLING. ....	371

	PAGE
Tuberculosis, Abdominal, in Children; Surgical Aspects of. ....	363
—JOINT; THE TREATMENT OF.—ELY. ....	261
—PULMONARY, AND ANO-RECTAL; ITS RELATION TO FISTULA-IN-ANO. GANT. ....	368
—Surgical; Results of Institutional Treatment. ....	331
—Wrist. ....	43

## U

Ulcer, Perforating. ....	234
Ulcers, Non-Obstructing. ....	322
—See Also Region of Ulcer.	
UMBILICUS, DERMOID CYST OF. See SMITH. ....	327
Uterine Replacement, Fixation Methods. ....	45

## V

VARICES, BROAD LIGAMENT. See KELSALL. ....	8
VARICOSE VEINS OF THE BROAD LIGAMENT: OR VARIX OF THE FEMALE PAMPINIFORM PLEXUS.—KELSALL. ....	8
VOMITING, THE SURGICAL SIGNIFICANCE OF.—GIBBON AND GIBBON..	335

## W

WAINWRIGHT, JONATHAN W.—SOME NEEDED IMPROVEMENTS IN OUR MINOR SURGICAL SERVICES. ....	322
WARNER, OTTO. — PROLONGED NITROUS OXID-OXYGEN AND MINIMUM ETHER ANESTHESIA FOR NEUROLOGICAL OPERATIONS; CASE REPORTS. ....	*70
Wassermann Contradictions. ....	176
WOOD, DOROTHY A., and M. E. BOTSFORD.—PRELIMINARY REPORT OF AN INVESTIGATION INTO THE OXYGEN PERCENTAGES OF NITROUS OXID-OXYGEN ANESTHESIA. ....	*117
Wound Excision, Results. ....	44
Wounds, Gunshot; Spinal Cord....	44
—Penetrating; Chest. ....	201
Wrist, Knee and Ankle; Ossification Centers at Birth; A Study.....	330

## Y

YEOMANS, FRANK C.—BIOPSY OF INTESTINAL TUMORS AND A NEW SPECIMEN FORCEPS. ....	376
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## Z

ZOBEL, ALFRED J.—RECTO-COLONIC HYDROTHERAPY. ....	403
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## THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM.

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### I. THE NOSE.

It is a matter of lively interest to humanity that the nose do its work well. This interest is so great that it is strange to find that attention to the pathology of the nose is to a great extent a matter of our own generation. In our older medical texts consideration of diseases of the nose covers not more than two or three pages. When many present day practitioners were undergraduate students perhaps one-half of a lecture was devoted to the same subject. But with the accumulation of special knowledge of the past decades growing out of the increase in clinical instruction, a special technique and a rapidly increasing literature has come into existence.

With the development of knowledge concerning the nose and its work came a realization that its prominence exposed it to injuries which became the source of other difficulties often not traced to their true source. Breaks, dislocations, and bruises, often looked upon at the time as negligible and of little moment, are later found to have caused blockages of the air passages which have interfered with normal breathing and with the drainage of the sinuses, and have caused serious nervous difficulties. Among the chief causes of these difficulties are deflection of the nasal septum. The development of surgical technique has made possible the correction of many of these difficulties with the aid of the knife.

It is the purpose of this study to put into a permanent form the result of many years of study of the causes and results of deviations of the nasal septum, together with a description of the operation for relief from the results of these deviations—the submucous resection of the nasal septum. Operations for these difficulties have been per-

formed not more than twenty years. The operation is still classed as one of the most delicate and difficult of intranasal operations, (Phillips, Porter, Harmon Smith.) It therefore seems desirable to add to the information available the results of the writer's clinic and private practice in dealing with several thousand cases.

In order to present more clearly the special study, we shall first consider briefly the normal nose, taking into account the pertinent features of its anatomy, physiology, and neurology.

The nose consists anatomically of two parts: the outer nose; and the nasal cavities contained in the skull. The lower segment is the part concerned in respiration. In the upper part the cavities support the membrane containing the nerves of smell. Posteriorly the nose is continuous with the cavity called the naso-pharynx, the two openings into which are called the choanae. The bony frame of the nose is a part of the skull, but the outer nose is supported by bone above only; the rest of its shape is kept by cartilaginous structures varying with race and individual. The anterior part of the nose is known as the ala or vestibule. This combination of bone and cartilage in the structure of the nose is of great importance, as we shall see in the study of fractures, dislocations, and deviations.

The roof of the nose, which is very narrow, is formed in front by the ethmoid and behind by the sphenoid. It is here, through the cribriform plate of the ethmoid bone, that some twenty non-medullated nerves pass to supply the sensory organs in the olfactory mucous membrane. This area comprising the olfactory sense is very small, about 5 square centimeters in area, according to Watson, and consists of a small membrane lining the roof and sides of each nasal cavity.

The external wall of the nose is the most important of its areas from the surgical point of view. Continued malformations of the septum react on this outer wall with grave results. This area is formed by the lateral mass of the ethmoid, the inner surface of the superior maxilla, the vertical plate of the palate bone, and the internal pterygoid plate of the sphenoid. To these outer walls are attached the turbinated bodies, structures made up of thin osseous shell and covered by a vascular cavernous



tissue possessing erectile tissue. These turbinated bodies project downward in such a way that the internal nose is divided into three cavities, or meatuses. There are usually said to be three of these bodies in the human nose, although by its lack of function and its difference in structure the body called the superior turbinate, situated quite above and behind and nearly always invisible, is perhaps questionably classed as a turbinate.

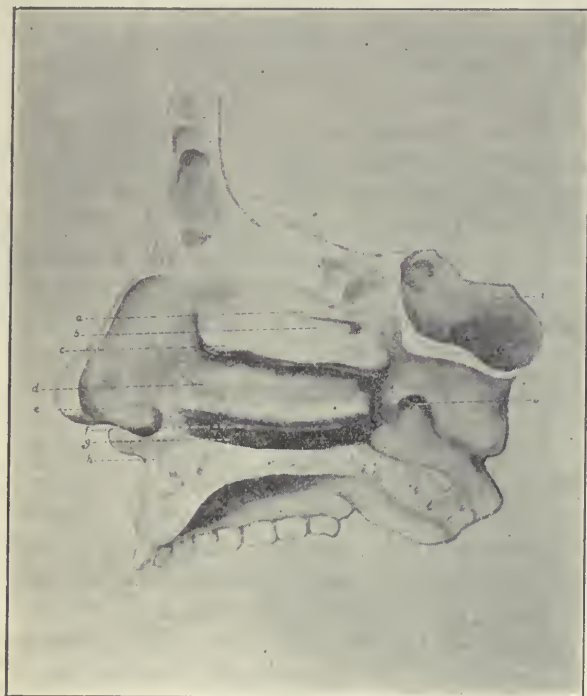


Fig. X-1—Specimen showing outer wall of internal nose, illustrating turbinated bodies and meatuses; *a*, superior turbinate; *b*, superior meatus; *c*, middle turbinate; *d*, middle meatus; *e*, vestibule; *f*, inferior turbinate; *g*, inferior meatus; *h*, superior maxilla; *i*, sphenoidal sinus; *j*, orifice of eustachian tube.

(Douglas.) (See fig. X-1, also the drawing of the structure of a deer's nose, fig. X-2).

The region between the so-called superior turbinate and the roof of the nose is known as the "recessus pheno-ethmoidalis." Into the back of this recess the sphenoidal air sinus opens. Between the superior turbinate and the middle turbinate is the cavity containing the openings of the posterior ethmoidal air cells. The middle meatus, between the middle and inferior turbinates, is the largest of the three, and contains certain important processes. Here are the opening of the frontal sinus, that of the maxillary antrum, and of most of the anterior ethmoidal cells. Towards the front of this cavity is a ridge, the processus uncinatus; further back is a rounded elevation called the bulla ethmoidalis. Sometimes the bulla is so enlarged that there is the appearance of two turbinated bodies in this region,

the outer being the bulla, and the inner the true middle turbinate. The bulla is probable a bone cell belonging to the ethmoidal system.

The inferior meatus lies below the inferior turbinate and extends to the nasal orifice. Its external wall contains the nasal duct, an opening into which a probe can pass to the lachrymal duct. This valvular opening lies on the highest point of the external wall of the inferior meatus. The Eustachian tube leading to the ear lies just behind the posterior border of the inferior meatus, and is almost on a level with the posterior end of the inferior turbinated body.

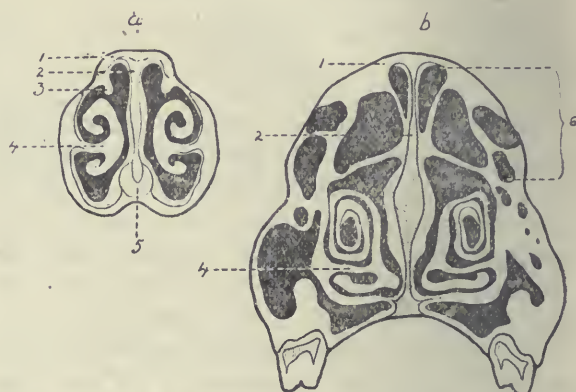


Fig. X-2—Vertical sections through nose of a deer; *a*, anterior; *b*, posterior; 1 ethmoid; 2 septum; 3 middle turbinate (no superior turbinate) 4, inferior turbinate; 5, muscular and cartilaginous structure at inferior extremity of nose; 6, ethmoid cells.

The nasal septum is the partition between the two nasal cavities whose features we have just described. It is composed of a triangular cartilage, the "septal cartilage," with a supporting framework made up of the perpendicular plate of the ethmoid above and of the vomer and the intermaxillary bone below. This cartilaginous portion composes about one-third of the divisional area. It extends from near the junction of the nasal bones at their median line to a point near the tip of the nose, and is more or less intimately attached to the nasal cartilages, with an under surface extending from near the nasal orifice along the ridge of the intermaxillary bone. (Fig. X-3. Construction of the septum.) Its posterior edge is attached to the vomer, and the perpendicular plate. The cartilage fits into the septal plate of the ethmoid, the vomer, and the intermaxillary ridge by means of a groove, half moon in shape. (X3-f.) This joint-like surface is of great importance in the study of pathological conditions of the septum, as we shall later have occasion to show, for it is here that injuries cause significant alterations. It should be noted that even with the majority of normal noses the cartilage

does not end with the smooth surface at the point of junction with the bones and groove, but sends out spurs, some normal, others individual or pathological. It is to this osteocartilaginous structure of the nasal septum that its many malformations are due, some of which involve the cartilage, the bone or both.

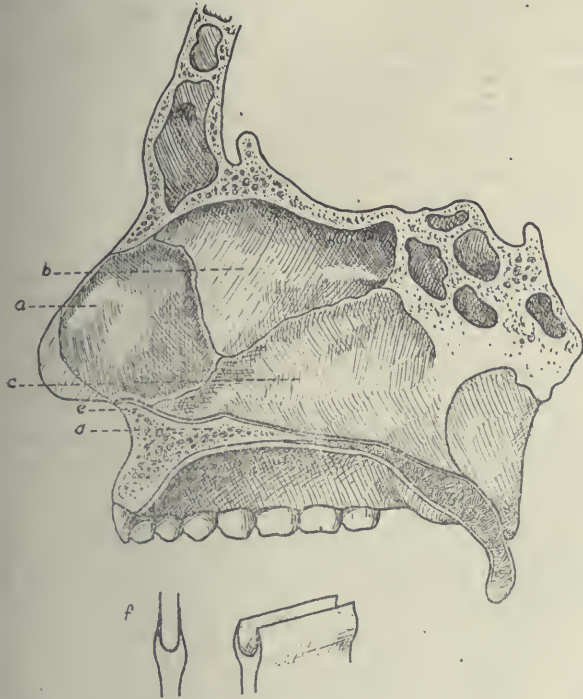


Fig. X-3—Diagram showing parts of septum; a, triangular cartilage; b, perpendicular plate of the ethmoid; c, vomer; d, intermaxillary ridge; e, crest of intermaxillary ridge; f, enlargement for triangular cartilage fitting into the moon-shaped groove of bone.

The greater part of the septum is covered with a thick and highly vascular membrane made up of columnar epithelium with masses of embedded glands. The less vascular but more highly specialized olfactory membrane covers a limited portion of the upper part. Opposite or a little below the anterior end of the middle turbinate there is a thickening on the septum resulting from an accumulation of glands. This is a danger point in the membrane, which is loosely attached to the septum, easily separable, and as a result easily a seat of abscesses and hematoma.

The nasal mucosa lines the nasal cavities proper but not the vestibule, which is covered by an invagination of the true skin of the ala studded with hairs or vibrissæ. This ciliated epithelium acts defensively against infection. The epithelium of the upper part of the nasal cavities, the olfactory region, is non-ciliated, columnar, and highly vascular. Thus the pathology of the membranes of the anterior and upper parts of the nose is quite distinct.

The vascular system of the nose is in close relation with the intracranial circulation. While there are idiosyncratic differences in individuals, it has been the observation of the writer that the greater part of the septal circulation comes from above. (Fig. X-4). The nasal branch of the ophthalmic artery supplies the upper part of the septum; the septal branch of the labial artery and a small branch



Fig. X-4—Diagrammatic sketch showing circulation of the septum.

from the facial artery supply the anterior part of the septum. In addition, the two naso-palatine arteries, derived from the internal maxillary artery, follow the course of the naso-palatine nerves as they pass along the sides of the vomer and enter the septal ridge. Some of the corpuscular elements of the blood exude from the capillaries to the surface of the glandular epithelium and aid in moistening the inspired air.

The nerve supply of the nose is equally extensive with that of the circulation. This has its unfortunate results as well as those more beneficent, for the nose is the source of innumerable reflexes. The naso-palatine nerves enter the septal ridge through the foramina of Scarpa, where they are so deeply protected by bony canals that it is difficult to reach them by anesthetic.

This brief outline of the structure of the nose indicates that we are dealing with a highly complex organ which because both of structure and location is peculiarly liable to derangement of function. These functions, of smelling and breathing, are of such paramount importance in the physical and mental integration of the organism that we shall



deal with them briefly before taking up the consideration of the pathology of the nasal septum.

## II. BREATHING AND SMELLING.

The nose forms the chief portal to the air passages. In fact, it is with the mouth the forefront of the passages leading to the chief thoracic and abdominal viscera. It exercises a high degree of control over the senses of smell, taste, and hearing. Of the sense of taste, it may be said that it is often true that what we think we taste, we smell. The sense of smell is buried deep in the nose. The Eustachian tube leading from the ear to the recesses of the nose, connects the sense of hearing with the functioning of the nose. It is also connected with the eye by the tear duct and by close nervous and circulatory relationship, a relation so close that it is estimated that a very large percentage of eye troubles originate in the nose. It therefore becomes evident on even cursory consideration that we moderns have been prone to underestimate the contribution of the nose to our power to adapt ourselves to the world in which we live. It has been estimated that by our neglect to cultivate the sense of smell we have lost by a third the power to remember. Doubly unfortunate, then, are those who by malformation are incapable of using this organ to their health and advantage. It would seem to be a matter of personal welfare to cultivate this organ, which somehow fell into bad repute, to keep it in good condition, and to restore it when it has lost its power of normal functioning.

Normally, the nostrils are open. This patency is constant, and can be increased in forced expirations by the action of the musculo-cartilaginous structure of the alae, which constitute in part a dilator apparatus. Subjects with over-thin nostrils often have respiratory difficulties. This is especially the case when there is in addition a septal deviation. Atrophy of the structure of the alae may be accompanied in such cases by hypertrophy of the dilator and contractile muscles of the upper cartilaginous tissues.

The region of the nose chiefly concerned in breathing is its lower segment, the part of it below the lower border of the middle turbinate and above the floor of the nose. In inspiration the greater part of the function is carried on between the lower border of the middle turbinate and the lower border of the lower turbinate; in expiration, the greater part of the air comes out through the inferior meatus. That this is true is illustrated by the enlargement of the posterior tip of the lower turbinate. The writer has observed the truth of these state-

ments in his dealings in New York clinics with silver polishers from the great hotels, in whose noses the path of the air currents is clearly marked by the shadings resulting from the polish they have inhaled.

The functions of the intranasal structures in the breathing process seem to be to warm the air, to moisten it, and to cleanse it by the action of the vibrissae of the ciliated epithelium. Although there seem to be air paths, as we have indicated, with eddies in the currents set up by individual peculiarities in shape, it may be said that all the surfaces of the nasal cavities come in contact with the inspired air. An exception to this statement is found in the olfactory region, which, while not closed off from the impact, is sheltered from direct impact by its position high in the nose. Since olfaction is carried on in the upper part of the nasal cavities, it follows that an obstruction in the upper part of the nose will affect smell. For the same reason, since respiration is carried on in the lower region of the nose, the high obstruction will not at the outset affect respiration.

Smelling cannot be carried on independent of breathing, although the anterior part of the nose is chiefly concerned in the one case and the superior or upper part in the other. On the contrary, smelling is dependent upon breathing. Before the scent of any object can be detected, the scent-laden particles of air must go through the narrow slit between the middle turbinate and the septum known as the sulcus olfactorius. (See the drawing of the deer's nose,) This narrow passage is the gateway to the sensory area of the nose, itself a small saddle-shaped membrane lining the roof and sides of the upper nasal cavity and out of the direct path of the air-currents which lead to the posterior part of the nose.

In order to produce an olfactory response the odoriferous substance must be placed in the field from which the air is inspired. The olfactory cell bodies lie in the sensory membrane, the peripheral process of each cell consisting of a number of hair-like structures which project into and slightly beyond the membrane. The other end of the cell gives rise to the nerve fiber, which can be traced upward through the sponge-like bone of the cribriform plate to end around cells situated in the olfactory bulb of the brain.

The olfactory bulb and tract lie beneath the sulcus rectus on the frontal lobe of the brain. The study of comparative anatomy gives phylogenetic evidence that the first stages in the development of the

cortex cerebri occurred in connection with the distance receptors for chemical stimuli, that is, in connection with sensitiveness to smells. The olfactory apparatus even in mammals exhibits a neural architecture of primitive pattern. The cell which conducts impulses to the brain from the olfactory membrane in the human nose resembles cells in the skin of the earthworm in that its cell-body lies actually amid the epithelium of the skin-surface and is not deeply buried near or in the central nervous organ. Moreover, one and the same cell by its external end receives the stimulus and by its deep end excites the central nervous organ. (See the article, Brain, 11th Ed., *Encyclopedia Britannica*, by Charles S. Sherrington.)

Minute particles by their impact upon the termini of the olfactory nerve processes produce the sense of smell. These receptors react to every minute chemical stimuli, probably gaseous particles given off from the stream of inspired or expired air coming into contact by diffusion with the olfactory membrane. The chemical stimuli to which the receptors for smell react are for some substances from 1 to 20,000 per cent. more sensitive than those of taste, although Zwardemaker's olfactometer shows marked variability in individual threshold capacity, with a lowering of the threshold in fatigue in many cases very marked. Hysteria and neurasthenia play their part in disorders of this sense as in the case with other faculties.

This brief description of the nose and its work is given in part to help us visualize the nose as one of the main receptive organs providing data for the rapid and accurate adjustment of the human animal to conditions of time and space, and to show more clearly the need for care in the preservation of the functions so necessary not alone to happiness but to health. A normal nose aids in the coordination of the activities of the trunk with the requirements of the head. Sherrington calls attention to the fact that the olfacto-phrenic respiratory arcs exemplify the integrative function. The nerve fibers from the cephalic receptors end in the grey matter of the central nervous axis not far from their own segment. Thence the conducting arc is continued backward by another strand of fibers, and these reach the mouths of the final common paths in the grey matter of segments of the spinal cord. The ramifications of the neurones attached to the smell receptors are so extensive and the reactions they excite are so far spreading that their association with the reactions and mechanisms of other receptors is especially wide-spreading. It is for this reason that the training, or perhaps better the reclama-

tion of the sense of smell can affect the memory and bring back from the unconscious so much of the past.

### III. COMMON SEPTAL DEVIATIONS.

Ideally, the nasal septum is perpendicular. As a matter of fact, among individuals of the Caucasian race, it is seldom quite median. If any judgment can be based on the number of applicants for correction of deflections, it may be said that negroes are comparatively free from such deviations. Morell Mackenzie found that asymmetry existed in nearly 77% of 2,000 Caucasian skulls examined. It is the opinion of the writer from his observation of cases entered in New York hospitals that fully 75% of all cases entered present septal deformities of more or less serious character.

In general, when we speak of a "deviated septum," we mean the exaggerations of the departure from the median which are pathological or obstructive. So long as the deviation is slight and causes no interference with breathing or with drainage from the sinuses, it is of little importance except perhaps from an aesthetic standpoint. Only deviations so pronounced and pathological as to call for surgical interference are the subject of this study. Among the chronic troubles resulting from their neglect are the following: Interference with breathing, obstruction of the drainage of the sinuses, pharyngitis, laryngitis, and catarrh of the middle ear. Ear difficulties almost always occur on the side on which there is interference with breathing, when the difficulties are the result of septal deviations.

In a consideration of the etiology of septal deviations, the writer as a result of his own observation finds himself in agreement with Killian that the majority of those calling for surgical procedure are traumatic. There are others, however, which can be grouped under the descriptive term "developmental." (Porter.) In the absence of a definite history, such a distinction is difficult. Except in the case of bowed deviations associated with a high arched palate, it is very probable that many supposedly developmental deviations are actually traumatic. This would be more true of boys than of girls because of the more violent sports of boyhood. There can be little doubt that with the extension of the present movement for the physical examination and care of school children, a connection will be uncovered between these deviations and retardations in development, but too early operation on growing children for such difficulties is to be deprecated. Such operations should be deferred until they have reached fourteen years or even later.



As it has been found that the resection of the septum relieves an imposing number of cases of hay fever and asthma, the writer ventures into this perplexing neurological field. In a general way, these diseases are classified as nasal reflex neuroses in which there is present hyperesthesia of the nasal mucous membrane—probably in the ethmoid region.

The work of Pavlov, Bechterew, Cannon, Crile and others has placed on a scientific basis "what has been known empirically for centuries, that emotional factors are capable of producing acute as well as structural alterations . . . as well as being constantly operative in causing so-called functional disease."\*

Neurologists hold that asthmatic attacks may have their exciting causes at any one of the three levels, physico-chemical (autonomic,) sensori-motor, or psychical. On the sensori-motor level the inducing cause may be pressure on laryngeal or bronchial nerves, or reflexes from the nose. The problem therefore in treating asthma is first to find which level is chiefly involved. It is here that a future lies for inter-relational therapy. It is possible that such baffling disorders as horse and cat asthma may derive their psychogenic etiological factors from the unconscious odor associations to which we have already referred (Chapter II). A union of forces among the branches of medicine and therapy will accomplish much to clear up such obscure cases and give relief to the unhappy victims. But before that time comes the surgeon has it in his power to benefit many cases. In narrow noses dust particles, steam heat, tobacco smoke, and other like irritations increase the hyperaesthesia. It is a matter of record that there have been more nasal difficulties since the building of the New York City subways, with their dust and stale air. In order to properly treat these cases free passage for air through the nose must be provided, and this often calls for the correction of septal deviations.

Various attempts at classification of septal deviations have been made. In view of the fact that so many of the deviations are traumatic, it is evident that we are dealing with such variables as the direction of the original blow, the resistance offered, the location of the trauma, the age of the victim, etc. We shall endeavor to clarify our description by classifying deviations as (1) bowed or curved, and (2) angular. To aid in visualizing them they may be called S-deviations and Z-deviations, picturing these letters as crossing the median line of the

septum. Such a rough general classification is an attempt to distinguish between the results of fracture and bending. It is evident that traumatic cases would most often fall among the Z-deviations, while the S-deviations would include along with traumatic deviations the greater number of so-called developmental deviations. There are, however, nondescript cases in which the bone and cartilage have been so injured and dislocated by the blow as to fall under neither of the suggested head-

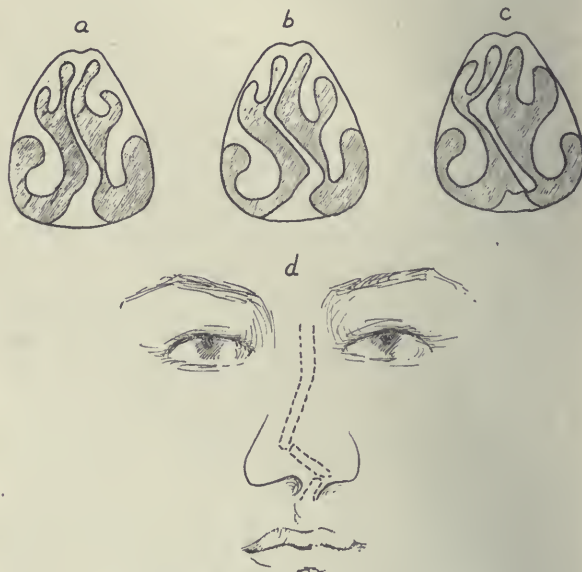


Fig. 1—Diagrams of typical deviations: a, "S" Deviations; b, "Z" deviation; c, nondescript with dislocation; d, fracture.

ings. Because of their special problems we shall later describe the surgical procedure necessary in dealing with such cases.

When we recall the distribution of function among the anterior and lower part of the nose, the posterior part, and the upper part, it will be evident that high deviations of either class do not cause interference with breathing experienced by those who have obstructions in the lower or anterior part of the nose. These anterior obstructions, some of which are almost horizontal, turn the air currents from their accustomed paths. In many of the S-deviations we find deflections of both bony and cartilaginous portions of the septum, many of them more marked anteriorly and curving out toward the turbinates in such a fashion as to interfere seriously with normal breathing (Fig. 1-a.) In such a type the lower part of the curve is often sharper, causing greater difficulty with this function than in the case of the upper curve. It is the higher curve that interferes with drainage and that is more apt to cause nervous symptoms. The line of deflection in these S-deviations is anterior-posterior, or

\*Smith Ely Jelliffe, and Wm. A. White, *Diseases of the Nervous System*, 3d ed, 1919, p. 122.

along the perpendicular line, instead of being almost horizontal as in many of the Z-deviations. In crossing the median line the deviation causes the blocking of both passages, with a marked low obstruction on the one side, a slighter high obstruction on the other. The variations in the S-type are not apt to be so extreme as in the Z-deviations, although the reservation must be made that there have been cases observed by the writer of the S-type which were so twisted as to approach the horizontal rather than the perpendicular plane. Because the S-deviations are more often true to type they form the basis for the operation described in Chapter IV. The special procedures will be described in Chapter V.

The angular, or Z-deviation, is an exaggeration of the curved or S-deviation, and presents more anomalies. As in the S-type the anterior deflection is more marked and is apt to be sharper than the posterior deflection. The original trauma may have resulted in fracture, with dislocations, blood clots, etc. (Fig. 1-b). These deviations are frequently associated with crests or ridge on the septum, usually a little above the floor of the nose and commonly along the line of the junction of the intermaxillary ridge, the triangular cartilage and the vomer, running upward and backward from the nasal spine. These ridges are sometimes very large, extending into the nasal cavity so far that they are in contact with the lower end of the inferior turbinates. They may be bony or cartilaginous or both, and always present difficulties in surgical procedure.

The muco-perichondrium covering the septum is normally easily separable from the septum. Its point of least resistance to injury is near the center. If a fracture occurs at this point it is often followed by hemorrhage. In the healing process the clots frequently become the centers of growths and adhesions, themselves obstructions and centers for further abnormal growths as time goes by. These thickenings and adhesions, accompanied by tension of the membrane, are the source of operative problems. The membrane on the convex side is liable to atrophy, as in the case of all convex surfaces.

It is evident that the Z-deviations are more involved, present more anomalies, and call for more variations in surgical procedure. In one of the more common variants of this type there is a low angular deflection which crosses the median line low in the nose at what approaches a right angle, returning to the perpendicular posteriorly with a wider angle. (Fig. 1-d.)

In both the S-deviations and the Z-deviations, as a rule, a low ridge obstructs the inferior and middle meatuses on the narrow side, while the other side is left too wide open, with the result that the inferior turbinate is often enlarged. The upper bend often forces the middle turbinate outward, thus causing obstruction to the drainage of the superior meatus and accessory sinuses. The lower part of the deviation presses against the inferior turbinate anteriorly, not as a rule posteriorly, while the upper curve presses against the middle turbinate anteriorly or for nearly its whole length. The posterior part of the obstruction is often bony and is usually covered with cartilage, while the spurs also are both bony and cartilaginous.

There are cases in which the force of the original blow was great enough to dislocate the septal cartilage from the moon-shaped groove into which it was originally fitted. The cartilage would then fall on one side or the other of the ridge, depending on the direction of the blow, and the groove would gradually be filled in with fibrous tissue. (Fig. 1-c.) Another result of this dislocation would be thickening and spurs, with an elongation of the cartilage. Cases of curved deviations accompanied by a sharp spur and a groove are especially difficult from the surgical point of view because of the danger of tearing the membrane.

Sometimes the septum has been torn loose in the anterior portion and pressed to one side. (Fig. 1-d.) As a result of such a dislocation part of the cartilage often lies in a position approaching the horizontal across the inferior meatus. Part of it may cross the median line and partially block the vestibule of the open side of the nose. In a good many of such cases the dislocated portion of the cartilage is separated from the rest of the septal cartilage by the fracture, the gap between the parts being filled with fibrous tissue. This creates a difficult situation and necessitates a variation in the technique of the ordinary operation.

It is not to be understood that this chapter has exhausted the possible varieties of classification of septal deviations. All that has been undertaken is to simplify the description of the results of trauma and resultant malformation in order to work out a method of procedure for the simpler cases, which can be modified to fit the less ordinary cases. With these facts in hand, the procedure in the classic operation for curved or S-deviations will be better understood and more easily modified to meet involved situations.

*(To be continued)*



# VARICOSE VEINS OF THE BROAD LIGAMENT: OR VARIX OF THE FEMALE PAMPINIFORM PLEXUS.\*

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It is my opinion that varix of the female pampiniform plexus occurs with greater frequency than is generally supposed, and because it is at times overlooked necessary operations upon the uterus or its adnexa for other affections fail in affording the patient complete relief.

The authors of most text-books on gynecology do not even mention broad ligament varicocele, and others who discuss the question dismiss the subject with two or three lines. Reed, of Cincinnati, who gives the matter greater attention than the majority, says: "Varicocele of the broad ligament is probably not as uncommon as supposed. There are but few operators of long and extensive experience who do not come, accidentally, across cases of this kind in their abdominal and gynecological work; yet we find the literature on this subject exceedingly meager. Rousans of Paris and Bagot of this country state that pelvic varicocele is of frequent occurrence." If I am not mistaken the first case of broad ligament varix reported in this country was by Dwight in 1887; four cases have since been recorded by Dudley, and two each by Malins and Zinke; Darnall (1914) stated that "he has operated on ten cases during the past year;" Winckel (Reed) found the condition present only ten times in three hundred necropsies.

The causes of broad ligament varix may be divided for convenience into (a) general, and (b) local.

*General Causes:* Subinvolution of the uterus and ovarian vessels with persistence of pelvic engorgement long after confinement, this in turn being produced by unrepaired or unhealed lacerations of the pelvic floor, too early and too much activity following labor, etc.; a relaxed condition of the tissues due to lowered vitality; an unhealthy state of the vessel walls; absence of valves in the veins.

*Local Causes:* The anatomical relations of the veins themselves, the spermatic and ovarian veins being of such great length that the weight of the long column of blood is sufficient in itself to somewhat weaken the vessel walls; habitual constipation with consequent daily straining at stool is another mechanical cause; malposition of the uterus, the organ being bent or turned backward producing

torsion of the vessels thus obstructing the free flow of blood and causing venous dilatation.

The reason varix occurs more frequently in the left than in the right broad ligament is thought to be that the venous blood from the left side empties into the left renal vein (a relatively small vessel) at right angles, whereas the right discharges into the large vena cava at an acute angle; the right side thus having freer and better drainage than the left.

The same anatomical grounds in the male explain the greater frequency of varicocele on the left side; the position of the spermatic vessels behind the ileo-pelvic colon and the anastomosis to the renal vein should be considered, especially the first factor when aggravated by chronic intestinal stasis. These mechanical elements are not, however, pathogenic; we have to take into consideration the condition of chronic inflammation of the fibrous tissue, which English authors call fibrosis or fibrositis and which is usually produced by a slight infection. (Adami).

An endophlebitis may, of course, also be a cause. There should also be added increased intra-abdominal pressure from any cause; frequent application of forceps during labor; repeated abortions and disease of the pelvic organs, such as pyosalpinx, ovarian prolapse, etc. Sometimes thrombi form and these occasionally undergo calcareous degeneration thus increasing the obstruction.

*Symptoms:* The clinical symptoms are somewhat similar to those of varicocele in the male. The pain is heavy, dull and aching in character, increased by long-continued erect position, correspondingly lessened and relieved when the recumbent posture is assumed. The patient may give a history of malaise, nervousness, general indisposition, and is sometimes melancholic. There may be frequent and profuse menstruation, amounting to metrorrhagia, and this may occur in women beyond the menopause.

We must remember that there is a reason for almost every physical discomfort, if we can but "run it down"; and there is an explanation of the child-bearing woman who vainly goes from one physician to another with aching pains in the pelvis and back, dragging sensation worse on standing and walking and worse at the menstrual period, and suffering from all the symptoms of pelvic engorgement and pelvic irritation, although the examining physician may not be able to palpate anything on which to base a diagnosis. By failure to find anything tangible, the woman is often assured that

\*Read before the West End Medical Society, Louisville, Ky.

there is absolutely nothing the matter and is in the mind of her doctor consigned to that large class of neurotics with imaginary symptoms which center in the pelvis. (Darnall).

**Diagnosis:** The clinical diagnosis of broad ligament varix occurring by itself must of necessity be difficult; but associated therewith other pathological lesions and varicosities are generally noted. Phleboliths are as a rule recognized only after the abdomen has been opened for the relief of other conditions. The knotted and swollen veins are best felt with the patient in the upright position; when recumbent only a "doughy" thickening is apparent. The presence of knotted and swollen veins determined by palpation, the patient giving a history of dull, heavy, aching pain together with the other symptoms outlined, should cause the observer to suspect broad ligament varix; but one must not feel too certain about the accuracy of his diagnosis. The surgeon is usually called upon to operate for associated disease, rarely for broad ligament varix *per se*; not infrequently, however, experienced surgeons after having made the diagnosis of salpingitis, oophoritis, or salpingo-oophoritis, have found at operation that both the ovaries and the Fallopian tubes were normal, and that an existing pelvic varicocele had caused all the pain and suffering.

Varicose veins (of the broad ligament) can rarely be palpated and then only with the patient in the standing position; but the diagnosis can be made from a careful study of the history and the clinical symptoms. (Darnall). Chronic appendicitis is the commonest error made in diagnosing these cases. Some of the patients are subjected to appendectomy with, of course, negative results. The diagnosis, chronic metritis is the next most common error. (Wall).

**Treatment:** Little need be said concerning the treatment as it is simple. Of course, if there is uterine retroversion or retroflexion, palliative measures, replacement, pessaries, knee-chest position, etc., may be tried; but it is well known that as a rule such procedures merely postpone the day of operation.

The operative treatment consists of multiple ligation of the veins with incision between the ligatures. If the ovary is prolapsed the Mauclaire-Barrows operation may be performed to advantage. Malpositions of other organs and any co-existing pathological affection must be given the requisite surgical attention.

There are in the medical literature some cases of retro-uterine hematocele and ovarian hemorrhage which possibly may be attributed to rupture of a

varicose vein. The bursting and bleeding may take place between the layers of the broad ligament, thus giving rise to a hematoma the result of which is ultimately and usually a fibrous newgrowth—a kind of fibroma. (Wall).

All of us have no doubt seen women operated upon for pyosalpinx, salpingo-oophoritis, uterine retroversion or what not, where everything was done at the time that was thought proper; and yet the patients were not completely relieved; they were still sufferers, "neurasthenics"; and these cases have had a tendency to bring ill-repute to recognized surgical procedures. Therefore, it is the hope of the writer that, thus calling further attention to the condition described, may be the means of contributing in small degree, at least, to more complete relief by gynecological operations.

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### EXOPHTHALMIC GOITER IN A GIRL OF SIXTEEN, WITH SPECIAL REFERENCE TO ETIOLOGY AND END-RESULTS FOLLOWING LIGATION WITHOUT THYROIDECTOMY.

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(From the Department of Diagnosis, Jones Clinic.)

The usual surgical procedure in exophthalmic goiter consists of ligation of the superior thyroid vessels at an interval of about one week, followed by thyroidectomy in three or four months. If thyroidectomy is not done at this time, increased hyperplasia usually takes place in the gland and a rapidly increasing degree of toxicity develops, which in many instances results fatally. However, we occasionally find patients who refuse operation for the removal of the goiter, and the results are usually not observed because the patients leave the care of the surgeon. In the case reported herein we have been able to observe the progress of a well-marked case of Grave's disease, as well as the end-results following ligation without subsequent thyroidectomy. The case also presents some interesting facts in regard to etiology.

Laura K., a Polish-American girl, aged 16, entered September 16, 1919, with a complaint of extreme nervousness, shortness of breath, bulging eyes and goiter.

**Family history:** Negative as to similar conditions, carcinoma or tuberculosis. The patient had five elder sisters, a young brother and sister, all in good health.



*Menstrual history:* The menstrual periods had not yet appeared. None of her elder sisters had menstruated before reaching 16 years of age.

The former health had been good, with no diseases of childhood.

*Habits:* Formerly two or three cups of coffee had been taken daily, but not recently.

*Present illness:* The patient's first symptoms of general weakness, with occasional aching pains in the legs, appeared just prior to 1919. At about the same time she noticed enlargement of the neck and

taking Lugol's solution. At the same time she had been taking some prescribed tablets.

*Physical Examination:* General appearance: The patient presented a dejected appearance (See Fig. 1). She was extremely nervous. Her height was 5 feet 1 inch; weight, seventy-five pounds.

*Scalp:* A moderate degree of seborrheic dermatitis existed. The hair was extremely thin, espe-



Fig. 1—Photograph illustrating the appearance of the patient, Sept. 18, 1919. (Published with permission).

exophthalmos, both of which symptoms have progressively become more noticeable. For the past year she has complained considerably of palpitation, progressive nervousness, general weakness and tremor. Dyspnea began six months ago and has steadily grown more severe.

The patient's appetite has been very poor. She eats cereals mostly. Such foods as meats, potatoes and toast disagree with her. Her bowels have been regular except for an occasional attack of diarrhea. Recently the patient has complained of sweating considerably, which is more marked at night.

Two months ago she had attacks of vomiting which lasted for 3 or 4 days. Three months ago her weight was 84 pounds. At present it is 75 pounds.

*Previous treatment:* For a period of one year the patient had taken a prescription which she described as "tea-colored, with the taste of iodine." This description would suggest that she had been



Fig. 2—Roentgenograms of upper teeth showing left second bicuspid and right first bicuspid abscessed. The right first molar shows a stump with two roots.

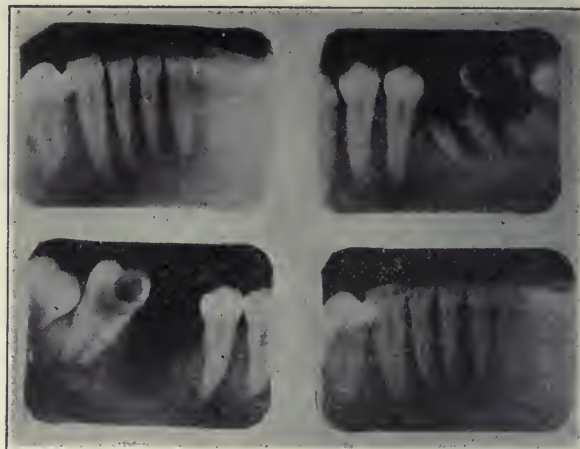


Fig. 3—Films of lower teeth, showing the right and left second molars abscessed, with a questionable abscess of the third left molar. The right first molar shows two remaining roots.

cially over the anterior portion of the scalp. There was marked prominence of the forehead.

*Eyes:* A marked degree of exophthalmos was present. (Fig 1). Von Graefe's sign was positive. The pupils reacted well to light and accommodation.

*Teeth:* A moderate degree of pyorrhea existed. There were several badly decayed teeth.

Her tonsils were very large; on either side they nearly reached the midline. There was marked chronic pharyngitis present. The submaxillary glands were enlarged and hard on both sides.

*Thyroid:* The gland showed moderate enlargement, which was more noticeable on the right side. It was movable and moderately hard. The circumference of the neck at its greatest diameter was



thirteen inches. The breasts showed no signs of mature development.

**Heart:** Inspection of the anterior chest wall revealed a visible heart beat which extended from below the ensiform cartilage upward into the vessels of the neck. A thrill could be palpated best at the apex, but could also be elicited over the entire precordium. A loud systolic murmur which was loudest at the apex could be heard throughout the chest. It could also be heard along both sides of the neck. There was marked tachycardia. The pulse-rate was 132. There was a systolic blood pressure of 130 and a diastolic blood-pressure of 60.

The lungs presented normal physical signs.

The abdomen, genito-urinary organs and rectum revealed nothing abnormal.

The legs and feet showed a mild degree of edema.

The patellar reflexes were normal.

A résumé on the day of examination was set down as follows: Exophthalmic goiter; x-ray teeth and extract by degrees; tonsillectomy; double-ligation of superior thyroid vessels; thyroidectomy.



Fig. 4—Photograph taken March 11, 1920, to illustrate the extent of edema in the hands, which was more marked on the right side.

**Laboratory Findings:** Roentgenography of the upper teeth showed the left second bicuspid and right first bicuspid to be abscessed. The right first molar showed a stump with two roots. (Figs. 2 and 3). Roentgenography of the lower teeth showed the right and left second molars to be abscessed, with a questionable abscess of the third left molar. The right first molar showed two remaining roots.

**Urine:** Slightly alkaline; negative for albumin, sugar and casts.

The blood: hemoglobin, 85%; leukocytes, 7600; polynuclears, 74.4%; small lymphocytes, 19.8%; large lymphocytes, 5.8%.

The Wassermann reaction was negative. The oxydase test showed a decrease in the amount of oxydase in the blood. 5 c.c. of a 1 to 400 dilution of blood liberated 9 c.c. of oxygen in 15 seconds when mixed with 3% peroxide. (Normal 15 to 17 c.c.)

**Treatment and Observations:** The infected teeth were extracted at the rate of one or two every four or five days.

September 29, 1919: The heart sounds were about the same as on the day of her first examination. The last two infected teeth were extracted. The pulse rate was 140. The systolic blood-pressure had dropped to 112, while the diastolic pressure remained at 60.

October 4, 1919: Tonsillectomy was done under local anesthesia. The tonsils were both very large. Each contained large areas of hard fibrous tissue, and small abscesses.

October 12, 1919; P. M.: She entered the hospital.

October 13, 1919. A. M.: The patient was prepared for ligation. She was given  $\frac{1}{8}$  gr. morphine sulphate by hypo. She became so excited and frightened that it was decided not to take her to the operating room. She was dismissed to return in one week.

October 19, 1919: The patient stated that she felt much better. The heart sounds were apparently the same. The pulse rate was 140; the systolic pressure was 110; the diastolic pressure was 60.

October 19, 1919: Again entered the hospital.

October 20, 1919. A. M.: She came to the operating room in good condition, but again became very excited; the pulse reaching 160. She was returned to her room.

October 23, 1919: Ligation of the left superior thyroid artery and vein was done under local anesthesia, using 1/5 of 1% cocaine with adrenalin. She stood the operation very well.

October 30, 1919: Ligation of the right superior thyroid vessels was done. Uneventful recovery.

January 19, 1920: The general appearance of the patient was improved. There was marked decrease in the amount of nervousness. The circumference of the neck was 12 in., a decrease of one inch. Her weight was 78 pounds; an increase of three pounds. The heart sounds were improved. The visible area of the cardiac impulse had decreased to an area of three inches in diameter, centered about the apex. Systolic blood-pressure, 108; diastolic, 50; pulse, 140.

The patient was urged to go to the hospital for a few days' observation previous to thyroidectomy. She delayed it, and continued to delay it until, after the latter part of February the decline began. She was seen on February 20, 1920. At that time the heart was severely decompensated. There was edema in both extremities which was very marked on the right side, as well as a moderate degree of ascites. (Fig. 4). The goiter had diminished in size so that it was scarcely visible.

March 10, 1920: The urine for the first time showed a moderate degree of albumin, and an abundance of epithelial cells. March 11, a rapidly increasing dyspnea developed and the patient died.

**Comment:** This case is rather interesting for several reasons. First, the marked severity of the disease in a girl of sixteen; second, the strong possibility of focal infection as a contributory factor in the etiology; third, the removal of foci of infection as a preliminary pre-operative measure, as done in this clinic; fourth, the result of ligation of the su-



perior thyroid vessels; fifth, the marked improvement following; and sixth, the rapid decline and end-results after the patient had procrastinated and delayed coming back for thyroidectomy.

The dental x-ray illustrations (Figs. 2 and 3) show several focal points of infection. Her tonsils were also very large, and their pathology decidedly showed infection. The reason for a girl of this age having such a marked case of exophthalmic goiter seems unexplainable unless it was due to the extensive amount of focal infection present.

After ligations, this patient improved remarkably. She delayed a much urged operation at the end of three months, the results of which are perfectly obvious. In this particular case it was more indicative at the three-month period than at the fourth. The decline was rapid. The patient died from cardiac decompensation associated with extreme emaciation.

*Conclusion:* 1. It is probable that focal infection is an etiological factor in exophthalmic goiter.

2. The progress of a case of exophthalmic goiter illustrates well the absence of permanent beneficial result from vascular ligation and other therapeutic measures without thyroidectomy.

### INTUSSUSCEPTION OF THE COLON CAUSED BY ANATOMIC DEFECT. A CASE REPORT.

LOUIS FRANK, M.D., F.A.C.S.,  
LOUISVILLE, KY.

The following case seems of sufficient interest to warrant its being recorded, not particularly because of the lesion which necessitated bringing the patient to me for operation but from the anatomic condition which was discovered after opening the abdomen.

On May 10, 1919, a child aged two years and nine months, was brought to me with the diagnosis made by the family physician of intussusception. We immediately opened the abdomen and found the entire cecum and ascending colon invaginated into the remaining portion of the large intestine and presenting at the anal outlet as was easily determined by rectal examination.

The invagination was easily reduced. It was then noted that the entire ascending colon and cecum were "hanging loose" within the abdominal cavity. There was tremendous engorgement of the mesenteric vessels of the ileum and also the ascending colon.

The child presented no further symptoms referable to the abdomen after the operation. Slight

localized signs of pneumonia were noted when the child was first examined, but we did not consider these sufficient to delay the operation which was performed under general anesthesia.

The feature particularly worthy of note, and my reason for reporting the case, is that the entire cecum, ascending colon and part of the transverse colon were freely intraperitoneal. This was not due to stretching of the normal attachments, but represented an anatomic defect congenital in origin. When the large intestine was lifted from the abdominal cavity it was noted that the lower part of the ascending colon and cecum had no mesenteric attachments.

After reduction of the intussusception the entire small intestine was found to occupy the upper right abdominal quadrant, and the descending colon, the transverse colon, the cecum and ascending colon had simply gravitated to the lower part of the abdominal cavity. The anatomic defect was overcome by anchoring these structures in their proper positions. This left underneath two fossae through which herniation is possible.

I have never before observed such an anomaly, and think it must be exceedingly rare. Search of the literature to which I have access discloses no similar example. The only way I can conceive that such a defect might occur would be that the cecum in its rotation and the descending colon in its descent, instead of pushing their way downward beneath the peritoneum and retaining their fixation to the posterior wall as normally occurs, pushed the peritoneum along in front of them. The defect was not artificially produced by stretching of the mesentery of the meso-colon.

It is presumed the anomaly described was the cause of the intussusception.

### DRAINAGE IN CHOLECYSTECTOMY.

In cholecystostomy there is no special problem in drainage; but in cholecystectomy the method and position of drainage is open to question. It is an axiom that the best drainage is dependent drainage which is frequently best secured through a counter incision at the bottom of Morrison's pouch. In fact, in cholecystectomy, the question of drainage is paramount, for if it is not adequate, a sub-phrenic abscess may be established. If adequate dependent drainage is not established through Morrison's pouch, then it must be ample through the abdominal incision, so that by no chance will there be an accumulation of fluid at any one point which may be dispersed by the respiratory movements.—GEORGE W. CRILE in the *N. Y. State Journal of Medicine*.



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WALTER M. BRICKNER, M.D., F.A.C.S., Editor.

NEW YORK, JANUARY, 1921.

## RESULTS OF SECONDARY PERIPHERAL NERVE SUTURE.

The observations on peripheral nerve injuries made by Weir Mitchell and W. W. Keen in the Civil War laid the foundation for the intensive study of these lesions in the cases which the World War provided in pitiful abundance. In physiology, symptomatology and clinical course, in prognostics and in treatment a wealth of material has been added to our knowledge, and made familiar to us through the admirable works of Tinel, Mme. Athanassio-Benisty and many others.

A sufficient time having elapsed, for the earlier cases especially, what is now of interest is an analysis of end-results in surgical operations for the restoration of divided nerves. Reports of these results have been made by various observers; and Professor Thorburn, of Manchester University, has published in *The Lancet*, (September 25, 1920) a brief but interesting survey of the larger series of these reports.

Of 108 personal cases of suture or grafting analyzed by Tinel, 14 were complete failures, 22, or say 20 per cent., showed practically complete recovery, and the remainder were regarded as improved.

S. W. Daw says that 40 per cent. of his cases showed signs of returning motor power after seven months.

J. Sherren found that of 21 cases of secondary suture some return of motor power took place in all, but that it was never complete.

R. Kennedy, examining after a long period cases occurring in civil life, claims that 73 per cent. of all sutures were completely successful.

Dumas investigated 115 personal cases of operation for war wounds of one nerve only, musculo-spiral; but it must not be forgotten that for several reasons this yields better results than any other nerve. He claims evidence of recovery in 42 per cent. of his cases, and of some regeneration in 65.2 per cent., the remaining 35 per cent. being presumably entire failures.

J. L. Joyce found in 36 cases of secondary suture 8 recoveries, 6 with considerable improvement, 8 with some improvement, and no result in 14.

H. S. Souttar and Twining found that of 61 cases of suture 7 recovered, 32 were recovering at the time of report, 7 were doubtful, 2 were failures, and 13 were not traced; but their results, like those of Joyce, would probably be improved by a later report, as in many cases the time elapsed had not been sufficiently long.

Adson reports the results of operation on 41 cases, four-fifths of which were end-to-end suture and the remainder plastic operations. Of 30 cases traced "the average amount of improvement obtained was 58 per cent. return of the sensory, 62 per cent. return of the motor, and 67 per cent. return of the trophic functions"; 73.1 per cent. showed improvement.

These figures, which are by no means easy to compare, leave the impression that secondary nerve suture gives very good results in somewhere between one-third and two-thirds of all cases, but . . . a perfect neurological recovery is rarely if ever obtained. . . . Complete failures are by no means uncommon, and must be looked for in a very definite percentage of even the best operations.

A study of the process of nerve regeneration effectively disposed, as unphysiological and futile, of the operation of suturing a divided nerve to the side of a healthy one; it showed that a nerve cannot be repaired, like a tendon, with plastic lengthening by dividing and turning some of its fibers. As compared with such plastic efforts nerve grafting is more physiological since it attempts to provide the channels in which the growing axons may descend; but grafting, too, is a doubtful measure that is to be resorted to only in those cases of larger defect in which, in spite of stretching, posture and shortening its anatomical course, it is impossible to bring together the divided ends of a nerve for accurate suture. Of grafting, which Thorburn also would employ only as a last resort, he says:

Certain isolated cases are reported in which brilliant results are claimed, . . . but there is certainly as yet no large number of good results obtained from grafting. . . . I have yet to see personally any cases in which it has been a success. I have seen cases in which it has been reported as successful, but which to my mind did not carry conviction.

Thorburn emphasizes the importance of distinguishing "physiologic recoveries," in which undoubted nerve regeneration has been accomplished, and "economic recoveries" in which the affected parts have been restored to a fair measure of usefulness, and he concludes, "the greatest optimism is generally that of the man who records a few remarkable cases—often a single case. After many years I can only say that if a surgeon obtains 50 per cent. of really good economic recoveries after secondary nerve suture he is doing well; if he ob-



tains 75 per cent. of such recoveries, which will bear investigation, his work is both brilliant and fortunate."

### SUBMUCOUS RESECTION OF THE NASAL SEPTUM.

Properly performed in suitable cases the submucous resection of a deformed or deviated septum is a beneficent procedure, indeed. Yet there are few of the common operations in surgery that are more often executed badly, upon insufficient indication and with unsatisfactory results.

We believe, therefore, that the series of articles on this subject by W. Meddaugh Dunning of New York, of which the first instalment appears in this issue, will be read with interest, since it will present clearly and concisely the anatomic and physiologic bases for the operation, the indications and the technics.

## Surgical Suggestions

With a streptococcus wound infection persistent diarrhea is strongly suggestive of sepsis.

Sarcoma of the lower end of the radius is usually of the relatively benign giant-celled variety.

The intravenous or intramuscular injection of pituitrin may be a life-saving measure in paralytic ileus.

With strangulation of a hernia very early vomiting, bloody vomitus and pain in the back suggest involvement of the mesentery.

In differentiating between gall-stones, ulcer and appendicitis, as the cause of epigastric pain, belching is significant of cholelithiasis.

Among the other non-surgical diseases that may symptomatically simulate acute appendicitis are pneumonia, malaria and the onset of measles or other exanthem.

Stricture of a salivary duct will produce the same symptoms as a stone therein. Stricture formation is not common and it usually occurs in the parotid (Stenson's) duct.

Intermittent swelling of the submaxillary region, generally associated with pain or discomfort on eating, means infection of the corresponding salivary

gland. Pressure on the gland will cause pus to escape from the opening of its duct. If sounding Wharton's duct with a fine ear probe or lacrimal duct probe reveals the presence therein of a stone its removal by incision in the floor of the mouth will usually cure the trouble promptly—unless, by too long neglect of the infection the gland has become disorganized.

In all cases of rectal cancer an abdominal incision should be made before attempting removal, if not for purpose of performing the "combined operation," at least to determine, by exploration of the mesenteric glands and the liver, the presence or absence of metastases. Even in apparently favorable cases there may thus be found a growth in the liver that quite precludes a radical operation.

## Book Reviews

**The Fundamentals of Human Anatomy**, including its Borderland Districts. By MARSH PITZMAN, A. B., M. D., Professor of Anatomy in the Dental Department of Washington University, St. Louis. Octavo: 343 pages; 101 illustrations. St. Louis: C. V. Mosby Company, 1920.

The avowed purpose of this "modern text-book of anatomy," is to present the subject from the standpoint supposedly most acceptable to the embryo-practitioner. An appeal is made that the sidelights of microscopic anatomy, zoology, embryology, physiology, pathology, the practice of medicine and surgery be permitted to illumine the subject of anatomy when it is taught, and that there be less anatomical pedagogy from the standpoint of pure science, with its inherent mass of detail. The author claims that the newer anatomies, in recognizing the first part of this broad point of view, have added so much borderland study, without diminishing the amount of pure anatomical material, that they have "gradually grown into encyclopedias of our entire anatomical knowledge of the human body," and that these colossal compendia are too massive to use "if we are to avoid 'mental indigestion'."

This work is an effort to make both ends meet without sacrificing either anatomy or breadth of view, but the amount of actual anatomical detail given is so slight as to be almost negligible. For example, a little more than a page is devoted to the brachial plexus, including a half page diagram. The author admits that "this book makes no pretense except as an auxiliary to more complete works," but we do not understand how the student can utilize a text of this nature with any other.

**Pensions and the Principles of their Evaluation.** By LLEWELLYN. J. LLEWELLYN, M. B. (Lond.) Late Temp. Member Appeals Tribunal Ministry of Pensions; Senior Physician and Governor, Royal Mineral Water Hospital, Bath (attached to Second Southern General Hospital); Fellow of Royal Society of Medicine, etc., and A. BASSETT JONES, M. B., (Lond.) Temp. Captain R. A. M. C.; Military Orthopedic Hospital, Whitchurch, Cardiff; Late Senior Surgeon, Cariganshire General Hospital; Fellow of Royal Society of Medicine. With a section on Pensions in Relation to the Eye. By W. M. BEAUMONT, Acting Ophthalmic Surgeon to the Bath War Hospital. Large octavo; 680 pages. St. Louis: C. V. Mosby Company, 1919.

While the basic facts employed by the authors emanate from England, their application is universal, and the methods described and detailed are of pre-eminent value



for the United States. Beginning with a historical review of the origin of pension systems, and an elucidation of the growth of the pension system in England to the present time, there is continued a variety of discussions on various aspects of pension legislation with a consideration of temporary and permanent pensions. The procedure in examination of claims for pensions is well illustrated by a variety of inquiries and examples which involve a thorough exposition of problems relating to the origin of disabilities, their evolution, and gravity.

More significant is the general tenor of the volume which deals with questions of human re-adaptation, which is a central theme to which financial equivalents are of secondary importance. Stress is placed upon the consideration of loss of function rather than on anatomical defects. With this point of view there is a most thorough and careful consideration of various injuries, and the factors to be considered in evaluating the assessments to be fixed. To this end there are separate chapters dealing with ankylosis, general and special fractures, scars, nerve injuries, lesions of muscles and tendons, bones and joints, amputations, together with special stress upon injuries of the eye, partial and complete blindness.

It is rare that one seizes upon the literary qualities of a technical volume as being of unusual merit, but the authors have manifested, even in their literary methods, a wealth of human understanding, a catholicity of view, and a sane, well-founded grasp of the essential spirit of a wise pension project. The wealth of surgical compilation in terms of prognosis, treatment, and functional restoration, is unequalled in any single volume familiar to the reviewer. Nor, indeed, is it possible to find a book in which an unstilted civic attitude finds finer expression.

There is a peculiar literary flavor that appears to transform the written word into sympathetic speech. It is a plea for right thinking, not merely in terms of anatomy, but in terms of function, personality, adaptation, individual and civic responsibility.

It is particularly timely, and the publication of this American edition should be regarded as a distinct contribution to problems that have arisen from the baneful effects of war, but no less to the equally damaging catastrophes and accidents of peace. The principles underlying the volume are the determination of the individual sacrifice, and a measure of the means and methods whereby this may be relieved so far as is humanely possible. It is a superior volume that crystallizes our present knowledge concerning the physiology, hygiene, surgery, education, ethics, and politics of pension systems.

**Collected Papers of the Mayo Clinic, Rochester, Minn.** Edited by MRS. M. H. MELLISH. *Volume XI, 1919*; Published September, 1920. Royal octavo; 1331 pages; 490 illustrations. Philadelphia and London: W. B. SAUNDERS COMPANY, 1920.

This volume of reprinted contributions from the Mayo Clinic and Mayo Foundation is uniform with its predecessors in size and arrangement, and in typographic and pictorial excellence.

**The Accessory Sinuses of the Nose.** By ROSS HALL SKILLERN, M. D., Professor of Laryngology Medico-Chirurgical College, Post Graduate School, University of Pennsylvania; Late Lieutenant-Colonel, M. C., U. S. A.; Fellow of American Laryngological Society; Fellow of American College of Surgeons; Fellow of the American Laryngological, Rhinological and Otolological Society; Fellow of the New York Academy of Medicine; etc., etc. *Third Edition.* Octavo; 410 pages; 300 illustrations. Philadelphia. J. B. LIPPINCOTT, 1920.

The third edition of this meritorious work, includes the author's experiences in the army with a number of cases of disease sinuses. He has also included new treatments and surgical procedures, that bring the book thoroughly up to date.

In our review of the first edition, we heartily commended the author for bringing out this special monograph. Dr. Skillern is recognized by his confrères as a man of exceptional ability. In this volume, as in former editions,

he has been very particular to give credit to every man who has advanced our knowledge of diseases of the sinuses, a subject, which, up to a few years ago, was looked upon as a closed field except to those who had had unusual opportunities.

**Neither Dead Nor Sleeping.** By MAY WRIGHT SEWALL. With an introduction by BOOTH TARKINGTON. Duodecimo; 320 pages. Indianapolis: THE BOBBS-MERRILL COMPANY, 1920.

A book designed to indicate a reason for believing in communication with the dead. Those who are interested in psychic phenomena will find themselves thoroughly interested, while unbelievers will be stimulated to further questionings as to the reality of contributions alleging communication with those who no longer live. At least the author had the purpose of aiding those hungry for psychic food that would further nourish their aching souls.

## Books Received

**The Oxford Medicine.** By Various Authors. Edited by HENRY A. CHRISTIAN, A.M., M.D., Hersey Professor of the Theory and Practice of Physic, Harvard University; Physician-in-Chief to the Peter Bent Brigham Hospital, Boston, Mass., and SIR JAMES MACKENZIE, M.D., F.R.C.S., LL.D., F.R.S. Consulting Physician to the London Hospital and Director of the Clinical Institute, St. Andrews, Scotland. In Six Volumes. *Volume II—Diseases of Bronchi, Lungs, Mediastinum, Heart, Arteries and Blood.* Large octavo; 817 pages; illustrated. New York. OXFORD UNIVERSITY PRESS, 1920.

**Anesthetics: Their Uses and Administration.** By DUBLEY WILMOT BUXTON, M. D., B. S., Member of the Royal College of Physicians; sometime President of the Society of Anesthetists; Member of University College; Consulting Anesthetist to University College Hospital and to the National Hospital for Paralysis and Epilepsy, Queen Square, and to the Royal Dental Hospital of London; Late Anesthetist to King George Hospital, and Administrator of Anesthetics and Lecturer in University College Hospital. *Sixth Edition.* Octavo; 535 pages; 89 illustrations. Philadelphia: P. BLAKISTON'S SON & Co., 1920.

**Nitrous Oxide-Oxygen Analgesia and Anesthesia in Normal Labor and Operative Obstetrics.** A Monograph Prepared for the Benefit of all Those Concerned in Safer and More Efficient Obstetrics and Anesthesia. F. H. McMECHAN, M. D., Editor. Octavo; 97 pages. Columbus, O.: NATIONAL ANESTHESIA RESEARCH SOCIETY, 1920.

**Common Infections of the Kidneys, with Colon Bacillus and Allied Bacteria.** Based on a Course of Lectures delivered at the London Hospital. By FRANK KIDD, M. B., B. C., (CANTAB), F. R. C. S., Eng.; Surgeon to London Hospital; Surgeon in Charge of Genito-Urinary Department, London Hospital; Member of the International Society of Urology; Member of l'Association Francaise d'Urologie. With an Additional Lecture on the Bacteriology of the Urine by DR. PHILIP PANTON, Clinical Pathologist, London Hospital. Octavo; 331 pages; 16 illustrations. London: HENRY FROWDE; HODDER AND STOUGHTON, 1920.

**Orthopedics For Practitioners.** An Introduction to the Practical Treatment of the Commoner Deformities. By PAUL BERNARD ROTH, M.B., Ch.B. (Aberd.), F.R.C.S. (Eng.), Senior Surgeon, and with Charge of Orthopedic Cases, Kensington General Hospital; Member of Orthopedic Section, Royal Society of Medicine; Late Surgeon, City of London Military Hospital; Senior Orthopedic Clinical Assistant, London Hospital, etc. Duodecimo; 190 pages; 57 illustrations. London: EDWARD ARNOLD, 1920.



**A Manual of Practical Anatomy.** A Guide to the Dissection of the Human Body. By THOMAS WALMSLEY, Professor of Anatomy in the Queen's University of Belfast. With a Preface by THOMAS H. BRYCE, M.A., M.D., Professor of Anatomy in the University of Glasgow. In Three Parts. Part I.—The Upper and Lower Limbs. Octavo; 169 pages; 59 illustrations. London: LONGMANS, GREEN & Co., 1920.

**The Anatomy of the Human Skeleton.** By J. ERNEST FRAZER, F. R. C. S., Eng., Professor of Anatomy in the University of London and Lecturer in the Medical School of St. Mary's Hospital; Examiner in Anatomy in the University of London and Lecturer in the Medical School of St. Mary's Hospital; Examiner in Anatomy for the University of London; Examiner in Anatomy for the Primary Fellowship of the Royal College of Surgeons of England; Formerly Examiner in Anatomy for the Conjoint Board of the Royal Colleges of Physicians and Surgeons. *Second Edition.* Quarto; 284 pages; 219 illustrations. Philadelphia: P. BLAKISTON'S SON & Co., 1920.

**History and Bibliography of Anatomic Illustrations,** in its Relation to Anatomic Science and the Graphic Arts. By LUDWIG CHOULANT. Translated and Edited with Notes and a Biography by MORTIMER FRANK, B. S., M. D. Secretary, The Society of Medical History, Chicago; Attending Ophthalmologist, Michael Reese Hospital Chicago. With a Biographical Sketch of the Translator and Two Additional Sections by FIELDING H. GARRISON, M. D., and EDWARD C. STREETER, M. D. Royal octavo; 422 pages; illustrated. Chicago. THE UNIVERSITY OF CHICAGO PRESS, 1920.

**Surgical Pathology and Morbid Anatomy.** By SIR ANTHONY A. BOWLBY, Kt C. B., K. C. M. G., K. C. V. O., F. R. C. S. Surgeon in Ordinary to His Majesty the King, and Consulting Surgeon to St. Bartholomew's Hospital; President, Royal College of Surgeons of England; and SIR FREDERICK W. ANDREWES, M. D., F. R. S., Lecturer on Pathology at St. Bartholomew's Hospital; Professor of Pathology in the University of London. *Seventh Edition.* Octavo; 636 pages; 210 illustrations. Philadelphia: P. BLAKISTON'S SON & Co., 1920.

**Tropical Ophthalmology.** By ROBERT HENRY ELLIOT, M. D., B. S. (Lond.) Sc. D. (Edin.) F. R. C. S. (Eng.). Lieutenant-Colonel I. M. S. (Retired); Late Superintendent of the Government Ophthalmic Hospital, Madras, and Professor of Ophthalmology, Medical College, Madras; Honorary Fellow and Gold Medalist of the American Academy of Ophthalmology and Otolaryngology; Lecturer in Ophthalmology, London School of Tropical Medicine; Ophthalmic Surgeon to the Seamen's Hospital Society, and to the Hospital for Tropical Diseases, Endsleigh Gardens, London. Octavo; 525 pages; 117 illustrations and 7 plates. London: HENRY FROWDE; HODDER AND STOUGHTON, 1920.

**Clinical Ophthalmology** for the General Practitioner, By A. MAITLAND RAMSEY, M. D., Fellow of the Royal Faculty of Physicians and Surgeons, Glasgow; Lecturer on Ophthalmology, University of Glasgow; Ophthalmic Surgeon, Glasgow Royal Infirmary; Author of "Atlas of External Diseases of the Eye," "Eye Injuries and Their Treatment," "Diathesis and Ocular Diseases," etc. With a foreword by SIR JAMES MACKENZIE, M. D., F. R. S. Large octavo; 500 pages; illustrated. London: HENRY FROWDE; HODDER AND STOUGHTON, 1920.

**The Endocrines.** By SAMUEL WYLLIS BANDLER, M. D., F. A. C. S., Professor of Gynecology in the New York Post-Graduate School and Hospital. Octavo; 486 pages. Philadelphia and London: W. B. SAUNDERS COMPANY, 1920.

**Plastic Surgery of the Face** based on selected cases of War Injuries of the Face, including Burns. By H. D. GILLIES, C. B. E., F. R. C. S., MAJOR R. A. M. C., Surgical Specialist to the Queen's Hospital, Sidcup; Surgeon in Charge of the Department for Plastic Surgery; and Late Surgeon in Charge of the Ear, Nose and Throat Department, Prince of Wales' Hospital, Tottenham; Late Chief Clinical Assistant, Throat Department, St. Bartholomew's Hospital; Hon. Fellow, National Dental Society of America. With Chapters on the Prosthetic Problems of Plastic Surgery by CAPT. W. KELSEY FRY, M. C., R. A. M. C., Senior Dental Surgeon, Queen's Hospital, Sidcup; Senior Demonstrator and Dental Officer in Charge of the Prosthetic and Metallurgical Department, Guy's Hospital; and Remarks on Anesthesia by CAPT. R. WADE, R. A. M. C., Late Senior Anesthetist, Queen's Hospital; Assistant Anesthetist, St. Bartholomew's Hospital; Anesthetist, Great Northern Central Hospital. Quarto; 400 pages; 844 illustrations. London: HENRY FROWDE, HODDER AND STOUGHTON, 1920.

**Functional Nerve Disease.** An Epitome of War Experience for the Practitioner. Edited by H. CRICHTON MILLER, M. A., M. D., Formerly Medical Officer in Charge Functional Cases, No. 21 General Hospital, Alexandria. Late Consulting Neurologist, 4th London General Hospital. Duodecimo; 198 pages. London: HENRY FROWDE, HODDER & STOUGHTON, 1920.

**The Sympathetic Nervous System in Disease.** By W. LANGDON BROWN, M. A., M. D. (Cantab.), F. R. C. P., (Lond.) Physician with charge of Outpatients, St. Bartholomew's Hospital, Physician to the Metropolitan Hospital, etc. Duodecimo; 147 pages; 9 illustrations. London: HENRY FROWDE, HODDER & STOUGHTON, 1920.

**The Story of the American Red Cross in Italy.** By CHARLES M. BAKEWELL. Duodecimo; 208 pages; illustrated. New York: THE MACMILLAN COMPANY, 1920.

**A Text Book of Pharmacology and Medical Treatment for Nurses.** By J. M. FORTESCUE-BRICKDALE, M. A., M. D. (Oxon) M. R. C. P. (Lond.) Capt. R. A. M. C. (T. F.); Physician to the Bristol Royal Infirmary and Clinical Lecturer in the University of Bristol; formerly Lecturer on Pharmacology in the University of Oxford. Large octavo; 371 pages; 74 illustrations. London: HENRY FROWDE; HODDER AND STOUGHTON, 1920.

**Practical Dietetics,** with Reference to Diet in Health and Disease. By ALIDA FRANCES PATTEE, Graduate, Department of Household Arts, State Normal School, Framingham, Mass., Late Instructor in Dietetics, Bellevue Training School for Nurses, Bellevue Hospital, New York City; Former Instructor at Mt. Sinai, Hahnemann and the Flower Hospital Training School for Nurses, New York City, etc., etc. *Thirteenth Edition.* Revised. Duodecimo; 469 pages. Mt. Vernon, N. Y.: A. F. PATTEE, 1920.

**Die Chirurgie der Brustorgane.** von FERDINAND SAUERBRUCH. Zugleich Zweite Auflage der Technik der Thoraxchirurgie von F. SAUERBRUCH und E. D. SCHUMACHER. *Erster Band.* Die Erkrankungen der Lunge unter mitarbeit von W. FELIX, L. SPENGLER, L. V. MURALT, E. STIERLIN, H. CHAUL. Large Octavo; 860 pages; 637 illustrations. Berlin: JULIUS SPRINGER, 1920.

**Des Andreas Vesalius, sechs anatomische Tafeln vom Jahre 1538** (in Lichtdruck neu herausgegeben und der 86. Versammlung Deutscher Naturforscher und Aerzte zur Feier der 400. Wiederkehr des Jahres seiner Geburt) dargeboten von MORIZ HOLL, Graz, und KARL SUDHOFF, Leipzig. Leipzig. JOHANN AMBROSIOUS BARTH, 1920.

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January

### CONTENTS OF THIS ISSUE

1921

THE ANESTHESIA PROBLEM IN GOITER SURGERY— GENERAL CONSIDERATIONS - - - - -	André Crotti, Columbus, O.	2
THE ANESTHESIA PROBLEM IN GOITER SURGERY FROM THE SURGEON'S VIEWPOINT - - - - -	Vilray P. Blair, St. Louis, Mo.	5
THE VALUE OF ANOCIATION IN GOITER OPERATIONS CLINICAL OBSERVATIONS ON 100 NITROUS OXID- OXYGEN ANESTHESIAS IN CASES OF HYPER- THYROIDISM - - - - -	W. E. Lower, Cleveland, O.	7
THYROIDECTOMY UNDER LOCAL ANESTHESIA - - - - -	L. F. Sise, Medford, Mass.	9
ETHER-OIL COLONIC ANESTHESIA IN GOITER SUR- GERY - - - - -	Carroll W. Allen, New Orleans, La.	12
INTRATRACHEAL INSUFFLATION OF ETHER IN OPE- RATIONS WHICH INVOLVE BLEEDING INTO THE AIR PASSAGES - - - - -	Walter Lathrop, Hazelton, Pa.	14
DOSIMETRIC CHLOROFORM AND ETHER VAPOR ANESTHESIA: SOME REFLECTIONS OF A SICK ANESTHETIST - - - - -	F. E. Shipway, London, England.	16
THE ANESTHETIC PROBLEM IN LUNG SURGERY - - - - -	T. W. Hirsch, London, England.	23
	J. T. Gwathmey, New York City.	28

### DEPARTMENTS

EDITORIALS - - - - -	26	SOCIETY PROCEEDINGS - - - - -	28, 31
BOOK REVIEWS - - - - -	22, 31	QUARTERLY INDEX - - - - -	32



## THE ANESTHESIA PROBLEM IN GOITER SURGERY—GENERAL CONSIDERATIONS.\*

ANDRÉ CROTTI, M.D., F.A.C.S.  
COLUMBUS, OHIO.

The ideal means of anesthesia for human surgery has not yet been found.

### MORPHIN NARCOSIS.

In dog surgery, however, we may say that a sufficient amount of morphin injected subcutaneously is the ideal means to put the dog under complete anesthesia. Soon after the subcutaneous injection has been made vomiting usually takes place; then the dog quietly goes to sleep and about one-half hour later, when the dose has been sufficient, the dog is completely anesthetized and the insensibility lasts so long that any major operation can be performed without the slightest indication of pain or struggle. No ill effects are observed afterward. The dose of morphin required varies, with the weight of the dog, and with the nervous temperament; as a rule, a dose of one or two grains is all that is necessary. Even much larger doses of the drug are not fatal to dogs.

The advantages of this method are too obvious; these alarming and spectacular respiratory or cardiac collapses which still too often occur with other means of anesthesia do not occur. During the entire artificial sleep the animal breathes regularly, and superficially, while the pulse remains good and strong all the way through. Unfortunately, this method so well suited to the canine species cannot be applied to human beings.

### LOCAL AND GENERAL ANESTHESIA.

For the time being, the two choice methods of anesthesia which we have at hand are local anesthesia with novocain, and general anesthesia with chloroform, ether and nitrous oxid-oxygen. Which one of these methods should be given the preference in goiter surgery and especially in Basedow's Disease? Should we use local anesthesia only or general anesthesia. And if we decide to use general anesthesia to what drug should we give preference, to chloroform, ether, or to nitrous oxid-oxygen? All these questions are by no means settled since the most prominent surgeons are divided in their opinions.

Kocher and others are of the opinion that general anesthesia is dangerous on account of its liability to cause asphyxia, bronchitis, pneumonia and cardiac collapse. They fear these alarming states

during which respiration and heart action stop, the face becomes pale, livid or cyanotic, pupils become dilated, and during which spell, despite artificial respiration and other restorative measures, the function of the pulmonary and cardiac mechanism remains momentarily suspended. To be sure, life comes back, but it does so slowly, and the patient's condition remains precarious throughout the operation. There can be no doubt that postoperative deaths in many instances would have been avoided if such cardiopulmonary accidents had not occurred, especially in thyrotoxicosis. Kocher attributes his low mortality to the use of local anesthesia.

On the other hand, Mayo, Halstead, Curtis, Garré, Ochsner, Crile and many others believe that a well conducted and well handled general anesthesia is less apt to be followed by severe consequences than local anesthesia. In fact, during the latter form of anesthesia the psychic emotions and shock may be just as marked, if not more, as with general anesthesia and their consequences just as disastrous. Certainly, real harm may be done to a patient by the mental strain and physical suffering while undergoing an operation without being unconscious. With local anesthesia the operation must be done very slowly, much time being lost in encouraging the patient, hence, prolonged operation and increased chances for surgical shock. Furthermore, a painless operation is not always so easily obtained. Finally, the results following local anesthesia are certainly no better than with general anesthesia. For these reasons it will be easily understood why many surgeons prefer the use of general anesthesia. *The choice between the two forms of anesthesia seems to be rather a matter of personal cohesion than anything else.*

### DANGERS OF GENERAL ANESTHESIA.

Before drawing our own conclusions let us study a little more fully the dangers connected with general anesthesia.

When the fumes of ether, chloroform, or nitrous oxid are impure, or when they are inhaled too abruptly, especially if the patient is a very nervous subject, reflex accidents may occur which may prove very alarming, sometimes fatal. They may occur even with the first inhalations of the drug. They are due to an abnormally intense reflex starting in the naso-pharyngo-laryngeal mucous membrane. We know experimentally that irritation of the nasal and laryngeal mucous membrane may cause a more or less marked diminution of the number of respirations and heart beats; or may even produce respiratory or cardiac collapses. The centripetal

\*Read before the American Association of Anesthetists, during the Eighth Annual Meeting, Hotel Grunewald, New Orleans, La., April 26-27.



route taken by these reflexes are the branches of the trigeminus and vagus nerves. The cardiac collapse is due to a centripetal reflex of the vagus nerve, which, we know, is a moderator of the cardiac apparatus. This inhibition, however, would be only a temporary one if the bulbar moderatory centers would not soon come into play and render the collapse permanent. The respiratory collapse is due to a centripetal reflex of the trigeminus, resulting finally in an inhibition of the respiratory centers.

Beside these alarming symptoms there are others of less importance, but nevertheless very annoying, such as coughing, increased amount of saliva due to centrifugal reflexes through the chorda tympani and the lingual nerves. These reflexes, of course, take place mostly during the early period of anesthesia, because at that time the reflex power of the nervous centers is increased; at a later period they become greatly diminished or suppressed.

General anesthesia with ether, chloroform, or nitrous oxid has other disadvantages. It is very often accompanied by a period of excitation. Furthermore, it is frequently followed either during or after the narcosis by vomiting.

#### AVOIDING THESE DANGERS.

To sum up, the dangers connected with general anesthesia are more than one; to a great extent they can be eliminated if certain rules are followed. In order to avoid the respiratory and cardiac collapse the anesthetic should be very pure; it should be given with extreme care and slowly, allowing plenty of air or oxygen to be inhaled with the anesthetic. The excitability of the patient should be diminished by a preliminary dose of morphin, or better, pantopon and scopolomin. *Theoretically, a sufficient dose of atropin would be ideal, as this drug suppresses at the same time the risks of cardiac collapse. Unfortunately this drug is too toxic and in order to be effective the doses would have to be too large. In smaller doses it is useful in diminishing secretions of the bucco-pharynx and trachea.*

A respiratory collapse can be avoided with a careful watching of the course of the anesthesia and the patient. If it does happen artificial respiration made in time may remedy the accident.

The great advantage of general anesthesia with volatile narcotics such as chloroform, ether or nitrous oxid, is that in case of necessity it can be stopped at will at any time. The patient himself is his best protection as he eliminates the poison with each respiration, whereas, if the anesthetic drug is used hypodermically the drug injected cannot be withdrawn, the detoxication lasts a long time and takes

place only through the kidneys, intestines and liver.

*From all that has been said it follows that it is impossible to set down hard and fast rules as to just what should be done in regard to anesthesia in goiter surgery. It would be ridiculous to proclaim ex cathedra that general anesthesia should be always used or vice versa. Here, as well as in any other medical question, there is a happy medium.*

#### INDICATIONS AND CONTRAINDICATIONS.

There is no question, for instance, that in patients with goiters of long standing and large size, with tracheal deformations, dyspnea and spells of suffocation, chronic congestion of the entire respiratory apparatus, myocarditis and arrhythmia, general anesthesia is contraindicated, as it would mean enormous risks for the patient. Consequently the surgeon and the patient should get together and consent, the one to perform the operation under increased difficulties and the other to undergo the operation with a little more discomfort and pain. But fortunately the majority of patients with simple goiter are in good health generally, their hearts are strong, their resistance as yet has not been impaired and the goiter has not had time to do very much harm. Under such conditions it is really more satisfactory for everybody concerned to use general anesthesia than a local one.

In Basedow patients, profoundly thyrotoxic, with a functionally insufficient myocardium, kidneys and liver, there is no doubt, too, that anesthesia, whatever it is, must be regarded as a great danger. It must be remembered that in such cases any surgical intervention, however small it **may** be, and no matter what form and nature of anesthetic, is dangerous; consequently, how to proceed is a matter of surgical tact, experience, judgment, and perhaps to a certain extent of personal preference. In the other class of Basedow patients which are still safely surgical a well conducted general anesthesia, carefully given and carefully watched, is the method to be chosen.

*In goiter surgery the great secret of success is to know how to proportion the surgical act to the condition of the patient. Too often, indeed, failures and misfortunes are charged to the anesthetic, when they recognize as the sole cause a lack of judgment and of experience on the part of the surgeon and an injudiciously performed operation, either because the right thing has been done at the wrong time or the wrong thing at the right time.*

#### WHICH GENERAL ANESTHETIC?

If we resort to general anesthesia, what drug shall we use, chloroform, ether or nitrous oxid?

It is now universally conceded that chloroform



is a dangerous anesthetic agent. The average death-rate with chloroform is about one death per 2,000 anesthetics. Very likely this average is low as probably a great many accidents are never reported. Chloroform is toxic for the blood as it destroys a certain number of red cells and diminishes the activity of the white cells. It is very toxic too for the kidneys and liver; a temporary nephritis and hepatitis are not infrequently the sequelae of chloroform anesthesia; even a fulminating icterus in absolutely normal patients has been observed after chloroform anesthesia. Furthermore, it is profoundly toxic for the heart and is an intense depressor of the blood pressure. For all these reasons chloroform must be excluded in goiter surgery.

For the time being the most popular and safest drug not only for thyroid surgery, but for any kind of surgery, is ether. It is the one used by the greatest majority of surgeons in America as well as in Europe. It is the one to which I give preference. It is superior to all others in safety and range of application, its record for mortality being one to 10,000.

I have operated more than 1,000 cases of goiter with this method of anesthesia. In my last 400 cases, made up of goiters of all varieties, including the worst thyrotoxic and malignant goiters, my death rate has been about two per cent. I do not use the anoci-association method any more.

Nitrous oxid anesthesia is not practical enough to be safe. While in the hands of Crile it has so far given excellent results, its preparation and administration are so delicate that it has not entered into every-day use in surgery. Crile says that unless very chemically pure and carefully administered by an expert anesthetist, this means of anesthesia is a dangerous one.

Possibly more than with chloroform, alarming states occur without any warning. The patient suddenly becomes livid, respiration fails, the pupils dilate, corneal reflexes become faint or absent. When once established these alarming states are far more difficult to handle than when they occur with other narcotic drugs.

"The shortcomings of nitrous oxid anesthesia," says Crile, "are, it is the most difficult anesthetic to administer; its effects are fleeting; there is an imperfect relaxation of the abdominal muscles; it is more expensive than ether and there is more venous congestion. The anesthetist must be an individual of the keenest perception of the precise condition of the patient at every moment, i. e., the

anesthetist must be a delicate human recording apparatus."

Dr. Charles K. Teter (Journ. Am. Med. Assn., Nov. 23, 1912) says: "That nitrous oxid is contraindicated in children under five years of age, in old people in whom arteriosclerosis is present. Nitrous oxid as an anesthetic is not ideal for patients possessing a strong, vigorous constitution, or extremely nervous temperaments, or in those addicted to the use of drugs, or the excessive use of tobacco. In other words, any patient who requires a large amount of anesthetic is not a good gas-oxygen subject for control, owing to the lighter forms of anesthesia induced by nitrous-oxid. The ideal patients for nitrous oxid and oxygen anesthesia are the very ill, the anemic, the debilitated, those possessing a low vitality from any cause, in short, all cases except those requiring a powerful anesthetic agent."

If we remember too that cyanosis, which so often accompanies nitrous oxid anesthesia, is not well tolerated by thyrotoxic patients, because it produces an increased adrenaline output, which in turn aggravates the thyrotoxic syndrome, we will have there another reason why many fear its use.

In the light of the above we may conclude that nitrous oxid anesthesia in general surgery is not yet a practical method. We may even say that except in the hands of those especially organized for its use, the method is not entirely safe.

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THE ASSOCIATIONS OF ANESTHETISTS AND OTHERS INTERESTED IN THE SPECIALTY OF ANESTHESIA ARE MOVING TO SECURE A SECTION OF ANESTHESIA IN THE AMERICAN MEDICAL ASSOCIATION DURING THE BOSTON MEETING, JUNE, 1921.

YOU CAN HELP IN THIS MATTER BY HAVING YOUR STATE MEDICAL ASSOCIATION PASS A RESOLUTION ENDORSING THE FORMATION OF THIS SECTION AND INSTRUCTING ITS A. M. A. DELEGATES TO VOTE FAVORABLY IN THE MATTER WHEN IT COMES UP FOR CONSIDERATION.

IF YOU ARE NOT IN A POSITION TO INFLUENCE YOUR STATE MEDICAL ASSOCIATION TO SUCH ACTION THEN HAVE AS MANY FELLOWS OF THE A. M. A. AS YOU CAN SECURE IN YOUR IMMEDIATE LOCALITY SIGN A PETITION TO THE SAME EFFECT.

DO THIS AT ONCE AND SEND THE RESULTS TO THE EDITOR OF THE SUPPLEMENT FOR SUBMISSION TO THE HOUSE OF DELEGATES AND THE COUNCIL ON SCIENTIFIC ASSEMBLY.



## THE ANESTHESIA PROBLEM IN GOITER SURGERY FROM THE SURGEON'S VIEWPOINT.\*

VILRAY PAPIN BLAIR, A. M., M.D., F. A. C. S.  
ST. LOUIS, MISSOURI.

It is fair to assume that in being asked to participate in this symposium on The Anesthesia Problem in Goiter Operations I am expected to present the subject from the operator's point of view.

The part of the subject assigned should rather confine my discussion to the general anesthetics that are commonly employed, but this would limit me to an aspect of the subject upon which scientific anesthetists, such as compose this body, are more conversant than the surgeons. If it be permitted, I prefer to take up the broader clinical phase of which the practice and results of various surgeons may be taken as an index and which will necessarily involve a comparison not only between certain general anesthetics, but also between general and local anesthesia.

You will probably more fully appreciate my reason for treating the subject from this standpoint when I state it is my present belief that the temperament and technic of the operator has in a general way a much stronger bearing on the proper choice of the anesthetic than the chemical properties or physiologic reactions that are peculiar to any particular anesthetic agent and this holds true to local as compared with general anesthesia. In making this statement, I believe I have stated the gist of my conclusions, but I will undertake to amplify somewhat my reasons for this conclusion by comparing the results obtained in certain clinics where a particular type of anesthesia has been employed in a large series of cases.

### METHODS OF CERTAIN OPERATORS.

Kocher, who had one of the largest experiences in goiter operations, absolutely tabooed the use of not only a general anesthetic but even of morphin, believing that the toxicity of the goiter was aggravated by them and that they therefore increased the operative risk. To him the psychic element was negligible compared to the toxicity that might be induced by drug administration.

Crile, on the other hand, takes the reverse view and in addition to the nitrous oxid-oxygen which he uses to induce anesthesia, he injects several other toxic substances employing a general plan of technic that in the hands of any less skilled surgeon might result in a high percentage of disasters.

In the Mayo Clinic the vast majority of thyroidectomies are done under straight ether anesthesia.

It would be difficult in analyzing the postoperative mortality of these three clinics to find sufficient grounds for a conclusion in favor of any particular anesthesia. However, I think it is perfectly fair to conclude that if in any one of these clinics they would undertake as a routine the plan followed in either of the other two, the death rate would rise materially.

*The similarity of results that obtain in the hands of different men, who, with large experience, have concentrated upon a certain type of anesthetic, does not mean that there can be no elements in the particular case pertaining to the choice of the anesthetic, but rather that the proper correlation of the anesthetic to the technic is of vastly more importance than the particular anesthetic agent employed. Unless he has been trained in a clinic where an ultimate plan has been perfected, the operator who is building up a thyroidectomy experience is not apt to feel that he will best conserve the interests of his patients and his own energies by accepting any particular anesthetic as routine until he has at least attempted to analyze the factors that bear upon the use of each. His conclusions will be influenced by temperament, operative skill, environment and preliminary training. It is probable that the same divergencies of practice will be found among the future authorities as among the present leaders, unless some predominating factor, which we do not yet recognize as such, should at some future time imperatively demand the unification of plan.*

### METABOLISM AND TOXICITY.

Studies of the metabolic rate have given a new criterion by which to judge as to the toxicity of goiter patients, and this, combined with the clinical picture, will, perhaps, show that the cases which do badly, react in this manner because of the degree of the thyrotoxicosis, rather than because of any errors in anesthesia and management.

In clinics where the metabolic rate has been studied an increase of 60 to 70 per cent., even without associated secondary damage to vital organs, has been found to be dangerous (Sistrunk, Journal A. M. A. LXXIV, p. 307). A rising metabolic rate is considered to contraindicate surgery (Means and Aub. Arch. Int. Med., XXIV, p. 645).

### MINIMIZING POSTOPERATIVE CRISIS.

The great outstanding factor at present is the recognition of the toxicity of goiters, which was the motif of Kocher's technic, as well as of the operators of the present day, but some early unfortunate

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experiences seem to have made Kocher less responsive to the fact that, in a given case, toxicity is in proportion to the mass of gland, and that the removal of a sufficient amount of the gland has an influence upon the intensity of postoperative thyroidism. *Any failure to adequately reduce the active gland substance will have superimposed a degree of metabolic exhaustion and nervous excitation upon a still active thyrotoxicosis, which may be even increased by absorption from the traumatised surfaces of the gland.*

*If operative measures can obviate or minimize the possibility of a postoperative crisis, it would logically appear to be by adequately reducing the amount of active gland tissue. By observations on the metabolic rate, it has been found necessary to remove all of one lobe, the isthmus, and the greater portion of the other lobe to bring this rate to normal.* (Sistrunk, *ibid.*)

Kocher, who removed but one lobe of the gland at an operation, sought to avoid postoperative intoxication by not adding other toxins and many operators today, even those who remove larger masses of both lobes, still believe that postoperative comfort and safety are conserved by a local anesthetic.

*Those who employ a general anesthetic with the best results are the men who produce the least psychic shock, operate quickly with the least traumatism, and who remove large amounts of the toxic gland.*

#### THE PROBLEM OF GENERAL ANESTHESIA.

I know of but two general anesthetic agents commonly employed in thyroidectomy,—nitrous oxid-oxygen and ether.

Hewitt says: "Whatever anesthetic be chosen (in thyroid cases) it is exceedingly important to remember that the safety of the patient depends upon the maintenance of a comparatively light anesthesia."

The excitement stage of ether is the most dangerous, and the service of an experienced anesthetist, who will promptly induce anesthesia, will be one of the greatest factors of safety in the use of ether in this disease. Perhaps the dosimetric method, where an inductionary tension of ether can be promptly given and an anesthetic level afterwards maintained, would be the method of choice. However, an experienced anesthetist can accomplish this without mechanical appliances.

*The increased respiration of the excitement stage, followed by acapnia, will be more apt to cause paralysis of the respiratory center in those cases*

*where the disease has progressed to secondary damage to the nervous system.*

*Ether has been shown to favor a postoperative acetoneemia and in this connection it is worthy to note that the increased metabolic rate, which exists, and continues for some time after the operation,—if it does not immediately temporarily increase, at least favors a very rapid exhaustion of the glycogen reserve of the body and this in turn favors acetoneemia.*

#### CONCLUSIONS.

In spite of the special factors that enter into thyroidectomy, I believe that on the whole the outcome must be largely influenced by the same factors that control the outcome in other types of operation and, in our own city at least, the deaths during nitrous oxid-oxygen anesthesia have been in such a preponderance over those occurring under ether that I am prejudiced in favor of ether, even though vomiting is one of the most serious symptoms of goiter, and vomiting due to ether will cloud the clinical picture, although not of such serious import as that due to the toxicosis. My own experience causes me to use local anesthesia on goiter patients who are really sick, either from intoxication or degeneration in essential organs, but for simple cases and cases of mild intoxication I use ether, and in tracheal collapse, rarely present, intratracheal ether insufflation. The use of preliminary narcotics is also advisable.

METROPOLITAN BLDG.

I HAVE HAD THREE PERSONAL IDEALS: ONE TO DO THE DAY'S WORK WELL AND NOT TO BOTHER ABOUT TOMORROW. YOU MAY SAY THAT IS NOT A SATISFACTORY IDEAL. IT IS; AND THERE IS NOT ONE WHICH THE STUDENT CAN CARRY WITH HIM INTO PRACTICE WITH GREATER EFFECT. TO IT MORE THAN ANYTHING ELSE, I OWE WHATEVER SUCCESS I HAVE HAD—TO THIS POWER OF SETTLING DOWN TO THE DAY'S WORK AND TRYING TO DO IT WELL TO THE BEST OF MY ABILITY, AND LETTING THE FUTURE TAKE CARE OF ITSELF.

THE SECOND IDEAL HAS BEEN TO ACT THE GOLDEN RULE, AS FAR AS IN ME LAY, TOWARD MY PROFESSIONAL BRETHREN AND TOWARD THE PATIENTS COMMITTED TO MY CARE.

AND THE THIRD HAS BEEN TO CULTIVATE SUCH A MEASURE OF EQUANIMITY AS WOULD ENABLE ME TO BEAR SUCCESS WITH HUMILITY, THE AFFECTION OF MY FRIENDS WITHOUT PRIDE, AND TO BE READY WHEN THE DAY OF SORROW AND GRIEF CAME TO MEET IT WITH THE COURAGE BEFITTING A MAN.

—Osler.



## THE VALUE OF ANOCIATION IN GOITER OPERATIONS.\*

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The vital test of any surgical method is found not in its effect upon the moderate risk—not even in its effect upon mortality rate alone—but rather in the mortality rate plus the postoperative morbidity. After any operation the first questions that naturally arise are: What is the immediate postoperative condition? Has the patient fallen a little lower before beginning the climb to health, or has a definite and immediate “boost” been given by the operation? Has the period of convalescence been lightened and shortened? Upon the answers to such questions as these depends the final verdict.

## GENERAL CONSIDERATION OF ASSOCIATION.

Therefore, in considering the value of the combined method which has been termed “anociation,” the case histories of the ‘bad risks’ should be considered, and best of all criteria would be the effect upon types of cases to which the various incidents of the operations—both psychic and material—in themselves are of peculiar menace. As has been emphasized heretofore, the term anociation, or anoci-association, implies an all-inclusive operative technic adapted to the individual case, whereby the noxious influences—psychic and traumatic—which inevitably attend any surgical procedure, are minimized or eliminated. It had its inception in the appreciation of the fact, established by experimental findings, that the inhalation anesthetic does not prevent afferent impulses from the traumatized field from reaching the brain. The response of the brain to the afferent impulses is manifested in the visible response of the vasomotor mechanism by increased pulse rate and by increased respiratory activity. The preliminary apprehension of an operation, especially in a bad-risk patient, may have a demonstrable deleterious effect. To obviate these noxious influences, therefore, a combination of narcotics and of anesthetics is used—morphin and scopolamin before the operation to diminish apprehension; a general inhalation anesthetic to produce unconsciousness, and a local anesthetic to prevent afferent impulses from the field of operation from reaching the brain; and in certain cases another local anesthetic to diminish postoperative local pain. Nitrous oxid-oxygen, which in itself in some measure prevents shock from trauma, as has been convincingly demonstrated in war surgery, is the an-

esthetic of choice, and is supplemented by ether only in such cases when the exigencies of the operation demand a greater degree of relaxation that can be procured by nitrous oxid, as in certain abdominal operations.

## EXOPHTHALMIC GOITER AND ANOCIATION.

No better example of a condition demanding such a method as anociation can be cited than that which is found in a severe case of exophthalmic goiter, which is influenced by every environmental factor. In the advanced case of exophthalmic goiter every physical contact, every anticipated change in environment, even pleasurable as well as painful, is marked by an exacerbation of the characteristic phenomena of the disease. In an extreme case the mere contemplation of the operation may be sufficient to carry the patient past the already limited margin of safety.

We may well consider, therefore, that any operative regimen which can save and restore one of these hypersensitive acute cases will do far more for the patient suffering from a disease of calmer aspect.

The starved patient with cancer of the stomach, or the patient exhausted from hemorrhage, presents grave but specific problems which in the main may be met by specific measures. The exophthalmic patient, on the other hand, presents a picture of disintegration which must be met by an all-inclusive plan of treatment which will control every controllable environmental factor from the first meeting with the patient in the surgeons office through the reception at the hospital, the pre-and postoperative periods, and follow the patient to the home for a prolonged, planned dietary and hygienic regimen.

## PRELIMINARY PROCEDURES.

The anociated operative treatment of exophthalmic goiter begins therefore with the first contact between the surgeon and the patient. As far as possible the prospect of an operation is ignored throughout the consultation. The patient is rather urged to submit himself to the surgeon for a period of observation and of hospital care. It is stated that an operation may perhaps be decided upon, but this the period of hospital observation will determine. The excitement of entering the hospital and the dread of the suggested operation, even with the most careful and tactful management, may prove difficult to control, but a trained nursing and resident staff will soon assuage fears while the routine hospital examinations will aid the belief that the promised treatment has begun. On an early day the anesthetist with the anesthetic parapher-

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nalasia may give an "inhalation treatment," after which "packs" are applied to the neck to anticipate the postoperative dressing. After only one such treatment it may be possible to let the inhalation treatment pass into anesthesia, and the preliminary ligation may be done at once. The paraphernalia of the operation is not carried into the room until the patient is unconscious, and is removed before consciousness returns. The local anesthetic has rendered the wound sufficiently painless and the neck dressings appear but a repetition of the "pack." After a suitable interval the second ligation is performed in the same way and the patient returns home for readjustment and a period of rest before the thyroidectomy.

plete operation may be performed in the patient's room.

#### OPERATIVE TECHNIC.

As for the technic of the operation itself, the utmost care is used to assure the preliminary blocking of all nerve-bearing tissue with novocain, which is used progressively until the exposure of the gland is complete. *The anesthetist will often be able to note when the knife has passed beyond the blocked zone by the altered pulse and respiration, which, in the unconscious state in this disease, respond to contact with a like exaggeration to that noted in the conscious patient. In this operation, as in almost no other, therefore, the anesthetist and the operating surgeon must work completely en rapport. It follows that the ideal anesthetist in this as other*

Old Series  
544

New Series  
166

Fig. 1—Exophthalmic Goiter. Reduction in Mortality Rate. Consecutive Ligations.

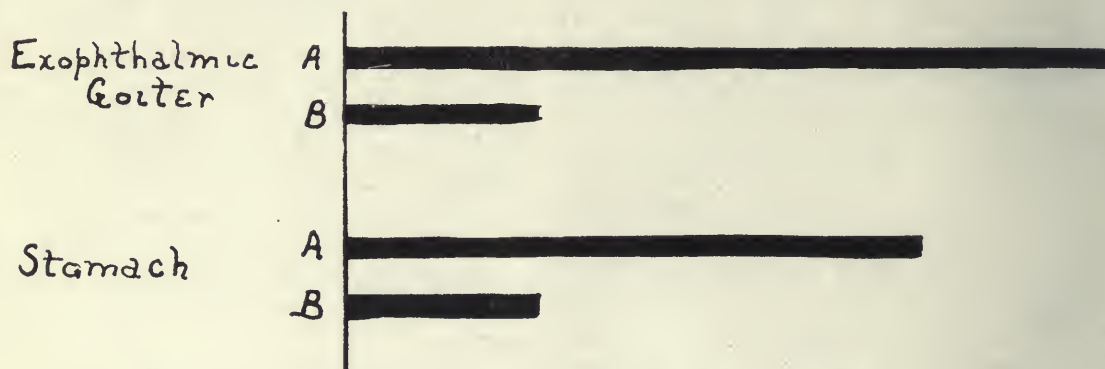


Fig. 2—Reduction in Mortality Rate by Graded Surgical Operation; (a) Former Mortality; (b) Mortality After Introduction of Graded Surgical Treatment.

#### THE REAL OPERATIVE PROCEDURE.

Upon the patient's return the hospital routine is the same except that the improved condition of the patient as a result of the diminished thyroid secretion makes it possible for the certainty of operation, which can no longer be evaded, to be borne with comparative equanimity. "Inhalation treatments" may again be resorted to, however, until the reaction is sufficiently slight, when the patient, after being anesthetized in his room, is transported under anesthesia to the operating room; the postoperative return also being made under complete anesthesia. In the most acute cases, or in one in which it may be advisable to resort to thyroidectomy at once without the preliminary ligations, the com-

operations, especially abdominal, is one whose specific training as an anesthetist is combined with sufficient knowledge of operative technic to assure the recognition of the approach to shock-producing areas in the course of the operation. The best anesthetists in my experience have been those whose specific training in the school of anesthesia was preceded by training in the operating room.

The incision should be sufficiently ample to allow the complete exposure of the gland to its lateral border, so that retraction may be minimized. The determination of the amount of gland to be left is an important point. In general we follow the plan of C. H. Mayo and leave a small margin adjacent to the larynx.

## SUPERIOR VALUE OF NITROUS OXID-OXYGEN.

*As for the anesthetic itself, perhaps in no other class of cases is the value of nitrous oxid-oxygen as compared with ether more clearly demonstrated. The absence of nausea, the easy and quickly attained unconsciousness prevent or minimize the dread of anesthetic which in the multiple stage operations in particular might become a dangerous factor.*

*Moreover, with nitrous oxid-oxygen the degree of unconsciousness may be graded to suit the condition of the patient at every stage in the operation. In certain cases it is never pushed beyond the stage of analgesia; in others the patient may be allowed to pass into deeper unconsciousness at certain phases of the operation, being quickly brought back to analgesia; in still others it may be safe to maintain a complete unconsciousness throughout. While it is true that such a task as the safe administration of nitrous oxid-oxygen to a case of exophthalmic goiter should be entrusted only to an expert anesthetist of mature judgment and of exceeding tact, nevertheless the anesthetic factor is of such prime importance throughout the surgical treatment of these cases that no pains should be spared by the surgeon to assure himself of this invaluable aid.*

## OTHER HELPFUL FACTORS.

The traumatic factors of the operation are controlled by the procedures which we have described. The psychic factors are controlled in part by the preoperative management, by the preoperative administration of morphin and scopolamin, and by the administration of the inhalation anesthetic in the patient's room. In the event of the postoperative hyperthyroidism, which in extreme cases may evade every precaution, morphin may be administered.

*Crile has used ice packs with striking success in cases of postoperative hyperthyroidism, finding it possible by this means to reduce the high temperature and rapid pulse to near the normal point within a few hours.*

We have said above that in no other class of cases must the surgeon and the anesthetist work in more complete accord; the same may be said of the nurses and the surgeon, particularly during the postoperative period. In fact after the operation is completed all depends upon two factors—the tact and understanding on the part of the nurse and the willingness on the part of the patient and of his family and friends to assure a continuance of a planned dietary and hygienic regimen for a prolonged period.

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CLINICAL OBSERVATIONS ON 100  
NITROUS OXID-OXYGEN ANESTHESIAS  
IN CASES OF HYPERTHYROIDISM.\*

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The anesthetics on which the following clinical observations are based were all given by the writer, and every operation for which they were given was performed by the same surgeon, Dr. Frank H. Lahey, of Boston. Therefore, as a cause of differences within the series, the personal equation is, as far as possible, eliminated. The series is consecutive, is taken without any selection, and during its course no case, no matter how sick, was permanently refused operation.

As the gradual result of Dr. Lahey's experience with different types of anesthesia, the method of anesthesia outlined below was developed by him with the co-operation, in some of the later steps, of the writer. The first anesthetic employed was ether by inhalation, but after it the toxic reactions, or thyroid storms, were so severe that it was abandoned. Then local anesthesia alone was tried, but the nervous reaction and the mental suffering of the patient during operation were too great. So scopolamin-morphin narcosis was used with the local anesthesia. This was a great improvement, and a few patients did perfectly with it, but the majority became restless at some stage of the operation. So nitrous oxid-oxygen anesthesia was added to the scopolamin-morphin narcosis and local anesthesia to form the present method.

## METHOD IN USE.

*Technic:*—Patients get rest in bed for a number of days, depending on their toxicity. Two hours before operation the patient is given a hypodermic injection of ¼ gr. morphin and 1/200 gr. scopolamin, and this is repeated one hour before operation. After these sedatives the patient is kept quiet and protected from light, and is gently transferred on a truck to the operating room, where she is given the same quiet and protection until the anesthetic is started. The operating table is broken in such a way that the patient is half reclining, half sitting at an angle of about twenty degrees. After the anesthetic is started the head is well extended. Novocain is used in the skin and other sensitive structures, and accurate, gentle surgery, with careful control of bleeding, is employed throughout. If the patient is thoroughly asleep from the sedatives,

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no gas is used. This rarely happens, however, and of course no such case is included in this paper.

*Induction:*—Almost without exception these patients, in spite of their natural nervousness, fall asleep quickly, in about one minute, and without disturbance of any kind. As the patient goes under there is a considerable tendency of the pulse and respiration to fall in rate, which, if the anesthetic is pushed too much, may become a marked depression. While this tendency is apparently aggravated by the partial asphyxia, due to a too rapid induction, it has nevertheless occurred several times in cases where there was at no time any cyanosis.

*Maintenance:*—Several factors, of which the chief are probably the preliminary drugging and local anesthesia, combine to make these cases among the very easiest to run. While the depth of anesthesia necessarily varies with different patients, in general only a light anesthesia is necessary. Usually a slight degree of cyanosis is present in the forehead, but none is evident in the ears. *Purely clinical observation and judgment of these cases seems to show that they require a higher percentage of oxygen to maintain their color than do non-toxic cases. And this would be entirely in line with theoretical considerations, as their basal metabolism is without exception above, and often very much above, normal, and the extra oxygen would be needed to maintain their abnormally rapid metabolic activities.*

#### INCIDENCE OF SHOCK.

Ordinary surgical shock is not present except in a few cases. In these it has been produced by operative measures which pressed or made traction on the trachea and obstructed respiration. With one exception the amount of shock has been so slight as to be hardly noticeable. In this one case such marked shock was produced that death resulted in about three hours. This patient was a woman in a critical condition, with an enormous intra-thoracic adenoma, and the shock was produced by the mechanical conditions incident to the removal of this huge growth from the chest. While she is included in this series because she had a secondary hyperthyroidism, the problems of her case are mostly mechanical and belong to a consideration of adenomata rather than to this paper, which aims to deal solely with the factors concerned with the toxicity of these cases.

*Respiration:*—Respiration runs about normal. The average rate for the series was 20. Very few cases ran above 25 or below 10 at any time. In no case was the average rate below 10. In the earlier cases of the series, 1/400 gr. scopolamin was fre-

quently added to the sedatives given above, and in these cases depression of respiration to the point of actual cessation occurred several times, with three occasions when the respiration failed to start without artificial aid. Actual cessation of respiration has occurred but once in the last half of the series; but whether the lessened number is due to the omission of the extra scopolamin or to increased familiarity with the reactions of these cases, is uncertain. In cases where the respiration stopped the pulse and general appearance remained good, so that no anxiety was felt. Most of the cases started respiration spontaneously. In those which did not, the last was the only one which required more than two or three compressions of the chest. When this case stopped breathing she was watched for one and one-half minutes before cyanosis began to appear. It was then necessary to compress the chest rhythmically for two minutes before spontaneous respirations started. Color was easily maintained and the pulse was good at all times. This was by far the most severe case in the series.

*Pulse:*—During maintenance the pulse varies widely. The average pulse rate was below 100 in 15 per cent. of the cases; from 100 to 149 in 46 per cent.; from 150 to 199 in 38 per cent., and 200 or over in one per cent.

*The anesthesia has had a well-marked effect in reducing the pulse rate; that is, the rate has usually been lower during the anesthesia than it was before the anesthetic was started. Thus the rate dropped in 75 per cent. of the cases; the average amount of the drop was 16 per cent. In nine per cent. of the cases the pulse was unaffected. In 16 per cent. it rose, and the average rise was eight per cent. The drop in pulse rate was especially marked in some of the earlier cases that were started under local anesthesia and finished with gas. In most of these cases the pulse rose steadily with local anesthesia and showed a decisive drop—sometimes as great as fifty beats—after starting the general anesthetic. The effect in quieting the pulse was one of the main factors which determined the addition of gas to the other procedures, as mentioned above.*

*Recovery:*—Recovery is slow. Patients leave the operating room in a drowsy condition, from which they wake on any stimulation, and into which they readily lapse again. This continues for a few minutes to a few hours, depending on the toxicity of the case. As the effects of the morphin wear off, more or less nausea and vomiting occur. There is also some complaint of headache.

*Immediate Reaction:*—The highest point reached by the pulse soon after the operation may be taken



as an indication of the severity of the reaction to the anesthetic and operation. This point is practically always reached within half an hour, usually within a quarter of an hour of leaving the operating room. It was below 100 in eight per cent., 100 to 149 in 57 per cent., 150 to 199 in 32 per cent., and 200 or over in 2 per cent. Thus there is practically no reaction, as the highest rate after anesthesia roughly approximates the average rate during the anesthesia.

*Final Reaction, or Postoperative Thyroid Storm:*—A toxic reaction may take place in any hyperthyroid patient after operation, usually on the first day after operation, but sometimes as late as the third day. It is responsible for a large percentage of the deaths in this class of operation, and is the bane of the hyperthyroid surgeon. Is it influenced by the type of anesthetic? With this question in mind the final results of this series of cases under nitrous oxid-oxygen anesthesia are herewith presented.

The grand mortality was four per cent. One of these patients had recovered entirely from the anesthetic, the operation and the postoperative storm and was up and about, but died on the twelfth day of acute appendicitis. This death, while largely due to the weakened condition of the patient as a result of her hyperthyroidism and recent operation, was otherwise in no way the result of the anesthetic or operation, and should therefore be excluded in considering the amount of final reaction which follows this type of anesthesia.

The exclusion of this death leaves a true mortality of three per cent. One of these patients died from immediate operative shock, and has been considered above,—a mortality from shock of one per cent., and two died from storm,—one on the first and one on the second day after operation—a mortality from storm of two per cent.

A far more accurate idea of the amount of reaction can be obtained by stating the amount of reaction in all cases whether it was severe enough to result in death or not. As the reaction depends largely on the toxicity of the case and the extent of the operation, these also must be stated. Likewise, some criterion must be given by which the toxicity of the case and the severity of the reaction can be measured.

No measurement of the toxicity or reaction can be made which is as good as the judgment of an experienced surgeon who takes all factors into consideration. This judgment, however, would be subject to such wide variations with different observers and is such a matter of personal equation that it

cannot be used in a paper of this sort. Only some one definite index should be used. If the work of different observers is to be compared, nicety of judgment in individual cases should be sacrificed to obtain a single, accurate standard which is influenced as little as possible by judgment or opinion. Now, in measuring the toxicity of a case one such guide stands out on the whole as much more accurate and reliable than any other. This guide or index is the basal metabolism.

It is unfortunate that there is no such reliable guide by which to judge the reaction. *In this paper the highest point touched by the pulse rate during the storm has been taken as the best standard available by which to measure its intensity.* All these cases had four-hourly postoperative charts kept until after the storm had subsided.

Two types of operation have been performed: (1) ligation of some of the poles of the thyroid gland as a preliminary to the final excision, in those patients who, for one reason or another, were considered unable to stand the complete operation; and (2) partial thyroidectomy.

Basal metabolism figures prior to operation were available in forty-one cases. This number is too small for an attempt at broad classification, but as the toxicity of these cases is determined much more accurately and uniformly than is that of the other cases in the series, and as a knowledge of toxicity is absolutely essential to an intelligent discussion of results, I should like to present a few of the main features of this group.

The toxicity as shown by the basal metabolism ranged all the way from 20 per cent. to 150 per cent. Sixty per cent. of the cases had a toxicity of 50 per cent. or over. There were 12 preliminary ligations and 29 thyroidectomies. The highest pulse rate reached during storm was 150 or over in about 10 per cent. One of these cases, a thyroidectomy with a toxicity of 87, died of storm on the second day, the only death from storm in this group. Six cases had a toxicity of 100 or over, the highest being 150, which, of course, classes them as extremely toxic, or critical cases. Four of these were preliminary ligations, and the highest pulse rate touched by any of them was 132. The two others were thyroidectomies, each with a toxicity of 100, and the highest pulse rate touched by either was 120.

#### CONCLUSIONS.

While the results in this series of 100 cases, and in the group of forty-one cases, and the experiences in developing this anesthesia from other forms, have convinced me that this is the most favorable form of



anesthesia for these toxic cases, I feel that the number of cases, and especially the number having basal metabolism determinations, is too small on which to base definite conclusions. The purpose of this paper will have been accomplished if it has made clear the technic, characteristics and results of this method of anesthesia.

31 POWDER HOUSE ROAD.

### THYROIDECTOMY UNDER LOCAL ANESTHESIA.\*

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In presenting this subject I can probably best serve the interests of this society by confining my discussion to those steps of the operation which pertain to local anesthesia. I will consequently omit all other discussion except to say that I prefer local anesthesia in all cases without exception, both the colloid and exophthalmic types. The size of the goiter, if very large, is no contraindication, and if the case can be operated at all, it can be more safely operated under local anesthesia.

In presenting the subject in this way I am not unmindful of the advantages, in bad risks, of a preliminary ligation of one or more poles of the thyroid as a preliminary step, and frequently make use of this practice.

#### NEURO-ANATOMY.

We can best perform any operation under local anesthesia when we possess a thorough knowledge of the nerve anatomy of the parts involved.

*Regional anesthesia is only possible here to a very limited extent and has no advantages.*

The skin, platysma and fascia receive their nerve supply from the superficialis colli, a large nerve which is formed by the second and third cervical. It passes forward around the sterno-mastoid about its middle and can be reached at this point beneath the deep fascia for blocking. It runs forward beneath the platysma dividing into two branches; the lower branch is distributed to the tissues over the thyroid, the upper branch between the thyroid and the chin. While this nerve can be blocked where it emerges over the sterno-mastoid this method has no practical advantage and is used only for class demonstrations, as it takes about ten minutes delay for the anesthesia to become well established, this time is wasted and as we accomplish only a skin and fascia anesthesia I rarely use it. What we

want is a simple method of anesthesia which is both economical in time and efficient in results.

The muscles and fascia which overlie the thyroid receive their nerve supply from the loop formed by the descendens hypoglossi and a branch from the second and third cervical, this loop descends on the carotid sheath and gives off branches just above the thyroid which pass down under the sterno-thyroid and sterno-hyoid muscles supplying them and the fascia around the gland.

The under surface of the gland is supplied by branches from this same loop given off just beneath it in addition to several filaments from the deep cervical nerves in the neighborhood. In addition to these nerves there is a large branch derived from the deep cervical plexus which courses forward around the trachea in close contact with the cricoid cartilage supplying the tissues around the isthmus of the gland. I have found this nerve often of large size and fairly constantly present but have not found it described in our anatomies.

A thorough knowledge of the nerve supply is essential, it saves time in making injections, permits us to use a minimum of solution in the right place, and in the event of some discomfort being felt during the operation we know at once from its location the nerves involved and know best where to make additional injections.

#### THE INFILTRATION TECHNIC.

The patient is prepared with a light meal and a hypodermic of morphin gr.  $\frac{1}{4}$  and scopolamin gr.  $\frac{1}{150}$  one hour beforehand.

A small intradermal wheal is produced with a fine needle over the center of the gland in the middle of the neck. A large syringe, of about five c.c. capacity, with a long, fine needle, is now used; the needle should be about four inches long and have a short, sharply beveled point. This needle is entered through the intradermal wheal and passed down to the deep fascia with the object of getting beneath the platysma muscle, the known position of the branches of the superficialis colli nerve, in this position its point is turned outward and slightly upward toward the superior pole of the gland, and the needle is slowly passed outward in this position injecting the solution as it is being advanced. The amount of solution used will depend upon the size of the gland, if as large as a small grapefruit 5 c.c. will be sufficient. If the syringe has to be re-filled it is detached, allowing the needle to remain in situ, thus avoiding an additional puncture. The needle is now withdrawn sufficiently to direct its point in the opposite direction and the other side of the neck is similarly injected. The long needle

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is now withdrawn and a small syringe and fine needle used to produce an intradermal line of anesthesia along the proposed course of the skin incision. The deep injection is purposely made first so that it has time to diffuse while the skin is being injected.

#### THE SURGICAL TECHNIC AND FURTHER INFILTRATION.

The tissues are now incised the entire length of the field down through the platysma, but if preferred the skin only can be divided and dissected up by dividing the platysma and deep fascia on a different level.

Having made this first incision down to the sterno-hyoid muscle the superficial tissues are dissected up, exposing the field. The long needle and large syringe are now used again passing the needle down under the sterno-hyoid and sterno-thyroid muscles into the tissues above the superior pole in the direction from which the fibers from the descendens hypoglossi come, injecting all the way as the needle is being gently and gradually advanced until a point is reached about one-half to one inch above the superior pole, injecting about 5 c.c. at each of these points on each side.

In making injections in the direction of any large vessels the needle should always be very gently inserted, stopping if any resistance is felt. It is also well to aspirate at short distances by withdrawing the piston of the syringe slightly, when if a vessel has been entered blood will appear in the syringe. While this accident should not happen if the technic is correct no damage will result if the needle is of the proper kind and has been handled gently.

Having made the above injection on both sides it is well to stop now and ligate all bleeding points, freeing the field of all forceps and getting rid of their weight on the patient's neck. This slight delay here permits the solution just injected to more thoroughly diffuse.

The muscles overlying the gland are now separated in the mid-line and either retracted or divided as necessary, freely exposing the surface of the gland.

The outer margin of the gland being well exposed a little traction is exerted slightly raising it from its bed and rolling it in towards the mid-line. A finger is now insinuated beneath its margin, which further aids in the elevation. This finger feels out the carotid vessels which lie beneath so that they are below and on the outer side of the tip of the finger. In this position the long needle is passed over the tip of the finger between it and the gland and the tissues under the gland lightly injected. The opposite side is treated in the same manner. An

additional injection is now made on each side of the trachea just above the isthmus to reach the nerve branches described as coming forward in contact with the cricoid cartilage.

If the gland is very large additional injections may be necessary just below the inferior pole, but ordinarily this is not necessary.

#### SURGICAL POINTERS.

This completes the anesthesia. The subsequent steps of the operation can now be carried out by any technic preferred by the operator. I always prefer to first divide the isthmus and roll the gland away from the trachea, thus avoiding any traction on this point which might produce a sensation of choking quite unpleasant to the unanesthetized patient. This is contrary to the usual method of operating here under general anesthesia, but has the advantage of increasing the mobility of the two halves and as they are rolled away from the trachea a much better view of the under surface is obtained and all injury to the recurrent laryngeal absolutely prevented. Except for this variation the technical steps are identical with those usually followed.

The essential steps in this operation as in all others under local anesthesia are a thorough knowledge of the nerve supply. The ligation of all bleeding points at several stages of the operation just following the injection of fresh areas, allowing the solution to diffuse while ligation is being done and ridding the field of unnecessary weight and encumbrance. Working from the trachea outward instead of in the opposite direction as is usually done.

#### SOLUTION.

The solution used is of secondary consequence, provided it is an efficient and safe local anesthetic; novocain 0.5 per cent. in 0.4 per cent. salt solution is preferred; with about five drops of adrenalin solution (1:1000) to each ounce provided not over four ounces are used; if more is needed the quantity of adrenalin is reduced. The cardio-vascular stimulation of adrenalin is dangerous in exophthalmic cases and should be reduced to the minimum.

509 MACHECA BLDG.

THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL HOLD ITS NINTH ANNUAL MEETING IN BOSTON, JUNE 6-7, THE FIRST TWO DAYS OF A. M. A. WEEK. LAY YOUR PLANS WELL IN ADVANCE SO THAT NOTHING WILL INTERFERE WITH YOUR ATTENDANCE AT THIS MEETING. AN EXCEPTIONAL PROGRAM IS BEING PREPARED AND BOSTON ITSELF IS SO FRAUGHT WITH ANESTHETIC INTERESTS HISTORICALLY THAT A VISIT WILL AMPLY REPAY YOU AND SEND YOU HOME WITH RENEWED ENTHUSIASM IN YOUR SPECIALTY.



ETHER-OIL COLONIC ANESTHESIA IN  
GOITER SURGERY.\*WALTER LATHROP, M.D., F.A.C.S.  
HAZELTON, PA.

Wilson and Plummer have divided the subject of goiter into three parts, or groups: 1. Nonhyperplastic atoxic, which would be the ordinary colloid and cystic type; 2. Nonhyperplastic toxic, which begins as a simple goiter and becomes transformed into a toxic type; and 3. The hyperplastic toxic condition, and exophthalmia.

## GENERAL CONSIDERATIONS.

The type commonly seen in this locality (Hazelton) is of the first group and often gives no inconvenience to the individual beyond the consciousness of its presence, and its cosmetic side, which appeals to the average woman. However, this very type may be gradually passing into the second group, and working its way insidiously into a systemic affection, shown by varied nervous phenomena often mistaken for other conditions, and frequently treated for indigestion and cardiac irritation, when in reality we have the beginning of a hypersecretion, and absorption of some toxic substance which, if not relieved, is very prone to pass to the third group. The picture is then recognized by almost anyone who sees the prominent danger-sign of exophthalmos. The inevitable complications that follow delay in these toxic cases are shown by "disturbance of nutrition, permanent organic damage to the heart structure, the kidneys, the adrenals, the exhaustion of the nervous system, exophthalmos, with possible loss of vision, the inevitable incapacitation in occupation and every day work." We have, then, an array of facts which justifies a positive stand in favor of surgical treatment, as compared with nonsurgical, in a large majority of cases.

All types of goiter are probably but stages in a general process, whether cystic, colloid, parenchymatous, or hyperthyroidism. Some cases have a distortion of the trachea from pressure; others have the growth extending down and pressing upon the lung—the so-called substernal type, producing dyspnea, and altering the size and shape of vessels.

The majority of women with goiter consult their physician more from annoyance or disfigurement than from suffering, while others realize that something is undermining their general health. It should be remembered that there is a close relationship between the thyroid and adolescence, preg-

nancy, menstrual period and uterine growths. Many enlarged thyroids in young girls return to normal after a few years, and these cases should not be operated upon unless the conditions are urgent; with dyspnea, and rapid heart action under ordinary exercise. Many young Italian girls have large thyroids at the age of twelve years, and these usually diminish after the age of fifteen or sixteen; if they continue enlarged, they should be removed.

The part played by the parathyroids is still an unsettled question, but that they exert a powerful influence on the body metabolism is a well known fact. Their removal is usually followed by a condition of tetany. MacCallum states that it is certain "that the parathyroids exercise a peculiar and very important function in preventing the appearance of an extraordinary change in the circulating fluids, which in turn produce an hyperexcitability of the whole nervous system. There is much evidence that it produces, or even consists in a disturbance of calcium which may well be the cause of heightened nervous irritability."

## FACTORS OF SUCCESS.

In the ordinary operation for goiter three factors make for success, namely asepsis, hemostasis and drainage. Standing above these possibly in the favoring of safety, is the anesthetic. While in no sense decrying the great value of nitrous oxid-oxygen, and ether, our personal experience with ether-oil colonic anesthesia, derived from *several hundred cases* anesthetized by *this method*, and *several hundred* by *inhalation* anesthesia, is most decidedly in favor of the ether-oil colonic type, as first brought out by James T. Gwathmey. His original method, with some variation of our own, has been our constant practice.

In cases where fear and apprehension are present, as in nervous women, and in hyperthyroid and exophthalmic types, the method is most gratifying, as will be shown later in this paper. In cases of hernia occurring in men who suffer with asthma, where inhalation is so distressing and dangerous, it is most efficacious. I do not decry local anesthesia in these hernias, for it is valuable, but many patients will object, and it is under such conditions that ether-oil colonic anesthesia is ideal.

In patients who are very fat, or who have short, thick necks, it is of great value. Needless to say, ether-oil colonic anesthesia is contraindicated in patients having colitis, hemorrhoids or other rectal irritation, or when pain is caused by its introduction. *We have had but two cases of postoperative irritation, or looseness of the bowels in all of our work.* The after-effects, as a rule, are equal to or

\*Read before the American Association of Anesthetists, during the Eighth Annual Meeting, Hotel Grunewald, New Orleans, La., April 26-27, 1920.



better than the inhalation cases, and postoperative vomiting is reduced to a small per cent., while the effect of the anesthesia is such that most patients rest very quietly for some hours, and complain of little or no pain. There is, of course, the irritation of the throat that would follow any method after removal of the thyroid gland.

#### TECHNIC OF ETHER-OIL COLONIC ANESTHESIA.

The technic followed in our work, and which has been modified some since the original method of Gwathmey appeared, is as follows:—

The *preliminary treatment* consists in giving two soap suds enemas one hour apart the night before operation; this is followed in the morning by another, using plain warm water. A special tube one-fourth inch in diameter, with an eye in the side, is used, and a clamp for the tube is also in readiness, as the tube is left in the rectum during operation. A small funnel is used to aid in the introduction of the mixture. One hour before operation the patient is given by rectum two drams of olive oil, three drams of paraldehyde and four drams of ether. These should be thoroughly mixed in a small bottle before being introduced to produce a proper consistency and then warmed. Twenty minutes after this is injected the patient is given hypodermatically morphin  $\frac{1}{4}$  grain and atropin 1/150 grain. Wait thirty minutes and then give three or four ounces of ether, thoroughly mixed with two ounces of olive oil (warmed). This should be given slowly, about one ounce per minute; the tube is then clamped and left in place (the tube should be inserted only about five inches). When the operation is completed, or nearly so, the clamp is removed, any mixture remaining is drawn off, the abdomen being gently massaged to aid in this, and then the bowel is carefully irrigated with tap water until the water returns clear, after which ten or twelve ounces are introduced and allowed to remain, or olive oil instead of the water may be left in, if preferred.

#### AN ILLUSTRATIVE CASE.

Let us give an illustrative hypothetical case: At 9 A. M. the patient is given the mixture of paraldehyde, ether and oil, as already mentioned; at 9:20 the hypodermic is given; at 9:50 the ether and oil is slowly administered, and by 10:15 o'clock the ordinary case is ready for operation.

If the patient is an alcoholic we omit the preliminary injection and give only hyoscin 1/100 gr. two hours before operation, and repeat in one hour with the addition of  $\frac{1}{4}$  gr. of morphin, and then follow the regular routine. This complication, fortunately, is not common. The Sims position is the proper

one for ordinary use, with the right leg acutely flexed.

#### NECESSITY OF A TRAINED ANESTHETIST.

The success of the method depends upon having *one person* to do the work, and to *have the patient under his or her entire observation before and during the entire operation*. The trained anesthetist will gradually be able to modify the procedure by the use of less of the mixture, thus obtaining equally good results. The administration should not be delegated to a different person each time. Should narcosis be slow in onset, or should the patient be restless, as will occur at times, a few whiffs of chloroform may be given. Should there be any cyanosis or stertor, it is an indication to either support the jaw with the head turned slightly to right or left, or to loosen the clamp and withdraw some of the mixture. Should respiratory embarrassment occur it should be treated as in any case of inhalation anesthesia.

#### ADVANTAGES OF THE METHOD.

The fact that a patient may be anesthetized in bed, removed to the operating room and operated without realization on her part is surely of great value, and must appeal to the surgeon who has to deal with a high-strung, nervous woman, who is apprehensive of danger. This is especially true in cases of toxic goiter, or hyperthyroidism, where every possible precaution is necessary and where we are dealing with a condition of high blood pressure, extreme nervousness and possible myocardial degeneration. These cases all need preliminary treatment by rest in bed, digitalis and calcium lactate before being ready for operation, whether it be a preliminary ligation of the vessels or a partial thyroidectomy.

The principle of anoci-association, as enunciated by Crile, can be realized nicely by this method of anesthesia, and nerve blocking can be used if so desired by the surgeon, and is very valuable.

To illustrate one of these severe types of cases, and to show how the gland may literally be stolen, we proceed in the following manner: Operation is set for Saturday, unknown to the patient. On the preceding Monday she is given an injection of two ounces of water, containing one dram of ether, and is told to retain this *for its tonic effect*; on Tuesday this is repeated, and so on each day until Saturday, when she is given the regular paraldehyde, ether and oil mixture, the hypodermic later, and in proper time the regular dose of ether in oil—all the while the patient remaining in bed. She is soon ready for removal to the operating room; in the majority of cases she knows little of what takes



place, awaking in bed with the ordeal over. This is surely of value, as anyone who has treated this class of patients will readily admit. The safety limit of this anesthesia is extended by the gradual absorption of ether by the colon and its rapid elimination by the lungs.

We do not advocate this method for general surgical work, as the time required for its proper use would prohibit it where a number of operations are scheduled. We have operated by the ether-oil colonic method in various abdominal conditions, to test it out, and have found it of value in many instances. The principal factor of safety is the wide margin between the dosage required for surgical narcosis and that which produces toxemia.

We are indebted to Dr. Gwathmey for the perfection of a method of anesthesia which is most valuable in selected cases, and one which, if used with proper care and observation, will add greatly to the convenience of the surgeon and the comfort of the patient.

STATE HOSPITAL.

#### INTRATRACHEAL INSUFFLATION OF ETHER IN OPERATIONS WHICH INVOLVE BLEEDING INTO THE AIR PASSAGES.\*

F. E. SHIPWAY, M.D.,  
LONDON, ENGLAND.

It is some ten years since Elsberg first used intratracheal insufflation of ether in the human subject, and seven and a half years since it was demonstrated at Liverpool by R. E. Kelly. Sufficient time has therefore elapsed to enable the statement to be advanced with some confidence that the value of this method has been established. It has, however, for various reasons, made somewhat slow progress in this country. The method has not, I think, suffered any set-back as the result of misguided enthusiasm on the part of its friends. It has only had to meet the opposition of its critics, who have either resisted its advance from an excessive caution, or from a mistaken conception of its difficulties. Its failure to secure more general adoption may also be due to the disturbing effect of the war on civil practice. On the other hand, injuries caused by the war were the means of bringing the method more prominently before the notice of those whose previous experience of it was slight. Its merits and demerits have long been known to some, and it is, I think, their duty to render an account of the knowl-

edge they have gained in order that others may be induced to readjust their views and to abandon their attitude of hesitation.

#### TYPES OF CASES.

My own experience is limited to some 930 cases; in 407 of these the method was used for operations on the face, mouth and pharynx, which were accompanied by bleeding into the air-passages. Since the claim has been advanced that intratracheal ether finds its most useful opportunity in intraoral surgery, I have chosen these cases, to the exclusion of others, as the subject of my paper. The cases have been arranged in three groups:—

(I) Gunshot wounds of the face, mouth and pharynx.

(II) Non-malignant disease of the mouth and pharynx.

(III) Malignant disease of the mouth and pharynx.

(I) This group contains 142 cases. It is marked off from (II) and (III) by the greater uniformity of age and a higher level of general physical condition. On the other hand, the average length of anesthesia was greater; many of the operations lasted over one and a half hours, twenty lasted two hours or more, the duration of the longest being three hours and seven minutes.

Plastic operations .....	117
Fixing wires or splints .....	22
Taking impressions .....	3

142

(II) There were 89 cases, the ages ranging from 8 to 70:—

Enucleation of tonsils .....	11
Operations on frontal and nasal sinuses .....	40
Operations on dental tumors and cysts .....	17
Multiple extractions .....	6
Various .....	15

89

Intratracheal ether was used on a few occasions for extraction of buried wisdom teeth when a long anesthetic was required; it is an ideal method for these cases. There were six children in all in this group under 12; average duration of anesthesia forty minutes.

One of the most interesting cases in this group was that of removal of polypi in a man aged 58; he was a fisherman, weighing 18 st., who had long been subject to attacks of urgent dyspnea due to extreme nasal obstruction. Examination showed the presence of a mass of polypi bulging down the soft palate to a considerable extent. The choice of anesthetic was not easy, but, for various reasons, I decided to give him intratracheal ether. Induction was unusually difficult owing to obstruction to breathing caused by a large tongue and the bulging

\*Read at a meeting of the Section of Anesthetics, Royal Society of Medicine, November 7, 1919. From the Transactions of the R. S. M.

of the palate, and it was not until the surgeon, Mr. Steward, held up the palate with his finger, while I held forward the tongue, that an airway could be obtained and induction completed. Five per cent. cocain was applied to the epiglottis and the catheter passed. Anesthesia was completely satisfactory. Some weeks later intratracheal ether was again given to him for the removal of more polypi.

(III) This group is subdivided into (IIIa) cases in which gland operation and operation on primary growth were done at the same time: (IIIb) cases in which primary growth alone was removed.

The classification of these cases has not been easy, and I have decided, after much consideration, to follow that which was adopted by Mr. Wilfred Trotter in his Hunterian lectures; it is based upon the anatomical distribution of the growth. I have, however, not excluded cases of cancer of the lip, and have placed under a separate heading cases of cancer of antrum, or ethmoid, which have necessitated removal of the superior maxilla; the latter do not appear in Mr. Trotter's figures.

(IIIa) 43 cases, in 9 of which glands on both sides were removed.

Mouth....	(1) Lip .....	6
	(2) Tongue (oral part) .....	19
	(3) Floor .....	10
	(4) Gum .....	4
Pharynx..	(1) Oropharyngeal .....	2
	(2) Epilaryngeal .....	1
	Removal of superior maxilla .....	1
		43

The youngest patient was aged 30, the oldest 73. There were seventeen cases between ages 60-70, and four over 70. The duration of anesthesia was necessarily long, rarely being under one hour. In one case one hour and fifty-three minutes, in another two hours and five minutes. The average duration of the lip cases was fifty-five minutes, of tongue seventy-three, of floor seventy-five, of gum eighty.

(IIIb) 133 cases:—

Mouth....	{	(1) Lip .....	8
		(2) Tongue (oral part) .....	47
		(3) Floor .....	8
		(4) Gum .....	11
		(5) Cheek .....	10
Pharynx..	{	(1) Oropharyngeal .....	15
		(2) Epilaryngeal .....	2
		(3) Pyriform sinus .....	1
		(4) Hypopharyngeal .....	2
	Laryngeal .....		2
	Removal of superior maxilla .....		25
	Removal of growth of nose.....		1
	Lateral rhinotomy .....		1
			<hr/> 133

The youngest patient was a girl aged 12, the operation being the removal of superior maxilla; she made an excellent recovery. Two patients were aged

80; and two operations for cancer of the tongue were performed on a man aged 79. Of the two octogenarians one had a small recurrence of cancer of the tongue; operation lasted twenty-five minutes; recovery was perfect. The other had a growth of antrum; this case is referred to later. There were fifty-six cases between ages 50-60, twenty-nine between 60-70, and, excluding those mentioned above, eleven over 70. The average age of the superior maxilla class was considerably less than that of the rest of the group. Of the two laryngeal operations, one patient, aged 69, was suffering from a growth of the anterior commissure which was causing some distress in breathing; laryngo-fissure was done but the growth was inoperable and tracheotomy was performed. Anesthesia was in every way satisfactory. In the other, tracheotomy was also performed, and the catheter was placed in the tube. This procedure has been found quite satisfactory on two other occasions. In the oropharyngeal group operation was limited in one case to enucleation of a sarcomatous tonsil. Five operations in this subgroup (IIIb) lasted over two hours; the longest took two hours forty-eight minutes; recovery was good and uneventful. Average duration of anesthesia in the lip cases was thirty minutes, tongue thirty-seven, floor fifty-nine, gum fifty-five, cheek forty-four, oro-pharyngeal sixty-five, superior maxilla seventy-six.

#### ADVANTAGES AND DIFFICULTIES.

Intratracheal ether is a great asset to both surgeon and anesthetist in this difficult field of surgery. It makes for the peace of mind of both. The careful dissection and deliberate technic of these operations are not hindered by anxieties about the anesthetic, nor hampered by the close presence of the anesthetist. The catheter presents no obstacle to the surgeon, the area of operation can be kept sterile, and the quiet easy character of the respiratory movements much facilitates dissection. For the anesthetist the administration is extremely simple, the breathing is unobstructed and the color remains good. The presence of blood in the mouth and pharynx is without danger to the patient.

Before proceeding to discuss the incidence of complications, or the mortality, I wish to comment on two points, one of which is connected with the technic, making it clear at the same time that it is not my intention to describe either the principles or the technic of this method; they are sufficiently well known. The first point—of supreme importance in the operations of group (I)—is the difficulty which may sometimes present itself of passing the catheter; the other is the advisability of giving a pre-



liminary narcotic. With regard to the former, it is certain that the anesthetist, however skillful he may be in the use of the direct laryngoscope, is at a considerable disadvantage compared with the laryngologist. He has to induce an anesthesia of sufficient depth to abolish (almost completely) the sensitive pharyngeal reflex and to pass the catheter before these reflexes return, or partially return. The laryngologist has the help of an anesthetist in keeping these reflexes in abeyance. *It is, then, wise for the tyro to recognize that he must approach the laryngologist for instruction, and practise under his eye the use of the direct laryngoscope under the most favorable conditions of posture, relaxation and quiet.* It is, of course, obvious that with increasing experience the difficulty of exposing the cords decreases. Until this dexterity has been acquired, advantage should be taken of the anesthetic action of cocain. I advocated this plan some years ago, used it for a considerable time, and am convinced that it is a safe and very helpful procedure. It is particularly helpful in conditions in which light anesthesia is indicated, and meets the criticism that has been made to the effect that the depth of anesthesia necessary for passing the catheter prohibits the application of the method in cases in which its use might be specially advantageous. Such cases are, for example, those of Graves' disease, or of certain types of intestinal obstruction with vomiting, in which intratracheal ether is highly valuable. Now deep anesthesia is not necessary. *But if the anesthetist is doubtful of success in any given case in which light anesthesia is indicated, he should, I submit, cocaine the pharynx and the epiglottis, either before or during induction, with a 5 per cent. solution.* As a matter of fact, I abandoned intratracheal ether for cases of Graves' disease shortly after ether-oil anesthesia was introduced, for I believe that by no other method of general anesthesia can the technic of Crile be so well carried out. At the same time the direct laryngoscope and catheter are always kept at hand during these operations, in case any difficulty of breathing should arise. Such an occasion did occur recently, and although anesthesia was of the type so frequently associated with ether-oil and it had been necessary to give the patient a little C.E. at intervals, there was no difficulty in passing the catheter. Nor has any difficulty been met with in cases of intestinal obstruction, in which deep anesthesia is dangerous, although it is only fair to admit that here the conditions are somewhat different; these patients are ill, and toxemia has dulled their reflexes.

*There were, however, some conditions during the war which were abnormal and presented at first very real difficulties. I refer to cases of gunshot wounds of the face and jaw in which there had been much loss of tissue, with subsequent scarring, contraction and deformity.* These were especially common in the early days of the war when treatment was non-existent or inadequate, and the type of neglected case which I had to anesthetize at the Maxillo-Facial Hospital again taught me that something more than a knowledge of the usual is demanded of our profession. Complete failure awaited me on six occasions, and on two or three of them not even a partial view of the larynx could be obtained. Failure occurred in the case of the same man on two different occasions. This was a serious matter, for the ordinary methods of anesthesia gave distinctly poor results, and there was some hesitation in opening the windpipe, particularly as this procedure might have to be repeated on subsequent occasions. Kühn's tube was not available, and as I felt strongly that intratracheal ether was the best method for these patients, it became necessary to look at the difficulties afresh and from every point of view, and to try to find a solution. *Reflection showed me that proper account had not been taken of the altered relations of parts, and that the head-down position used by the laryngologists is the worst possible for these cases of contracted mandible. All difficulties usually disappeared when the patient was raised to the semi-recumbent posture and the head somewhat flexed, and on the third occasion of my anesthetizing the man on whom I had practiced unsuccessfully twice before, the catheter was passed with ease.* Probably by a scarred and adherent tongue was presented the most serious obstacle in these war injuries, but by a careful examination of the altered anatomy beforehand and by attention to posture, intubation should be successful. I do not mean to imply that I met with no difficulties; some of these patients were very difficult, particularly if the mandible had been splinted, but if success was not attained at the first attempt sufficient knowledge of the special obstacles had been gained to enable one to succeed at the second. Above all things good illumination is essential. I have gone somewhat fully into this question, in the hope that my experience may be of use to others.

#### PRELIMINARY NARCOSIS.

The second point—viz., the advisability of giving a preliminary narcotic, is of almost equal importance, and in coming to a decision several factors must be taken into account. Two which at once present themselves are the predilections of the sur-



geon and of the anesthetist—their views may be totally opposed,—and idiosyncrasy on the part of the patient. The latter is rare, and occurs only when comparatively large doses are given. Other factors are the age and condition of the patient, the nature of the operation and the probable length of anesthesia. As regards the very young, I feel myself to be on pretty safe grounds in stating that morphin is contraindicated. To no patient, young or old, should morphin-scopolamin be given. As regards old age, the decision is not so easy, although it might appear at first sight that in this particular type of operation the anesthetist should use no agent, in addition to the anesthetic, which would have the effect of delaying the return of the reflexes. This objection is valid if the patient is anemic or toxic or asthenic, and may be upheld in the epilynggeal and hypopharyngeal groups. Anesthesia is usually prolonged in them, and a postoperative tracheotomy may be necessary in order to prevent any difficulty in breathing when the catheter is removed. There would seem to be a considerable body of feeling in favor of the withholding of morphin from patients who have been tracheotomized. On the other hand, if we exclude these groups, morphin offers such great advantages to the patient and to the anesthetist who is using intratracheal ether, that he should hesitate long before deciding against its exhibition. One of these advantages is the absence of excitement or struggling, or the lessening of struggling during induction. *It is notorious that the victims of cancer of the mouth are frequently elderly men who have indulged freely in alcohol or tobacco, men, that is, in whom great excitement during induction is to be expected. Now struggling represents a serious loss of energy and throws an excessive strain upon an impaired cardiovascular system. It is, unhappily, such a comparatively common event that it is looked upon as of no material import; and there is danger that the fact may be lost sight of, that over-exertion or severe effort sustained over even a short period of time on the part of the conscious subject is sometimes followed by acute cardiac distress or syncope. Violent struggling is, therefore, I believe, not infrequently the cause of sudden death following operation, or of gradual cardiac failure during the first forty-eight hours of the postoperative period. In the latter case the waste of energy during induction and the strain of operation, added to the inability to partake of solid nourishment, constitute a tax upon the resources of the patient which may easily turn the scale against him. For these reasons, I advocate,*

*whenever possible, a small dose of morphin, preferably 1/6 gr. for the elderly patient.*

Morphin also enables the anesthetist to maintain a much lighter anesthesia; this is particularly true of intratracheal ether. The administration is constant and the control extremely delicate. What exactly constitutes light anesthesia is almost a matter of personal opinion and practice. I believe that, in general, anesthesia is maintained at too great a depth. But whatever difficulty there may be in maintaining light anesthesia with the ordinary methods, there can be none with intratracheal insufflation, a system that delivers the anesthetic with an even precision below all possible sources of obstruction or spasm. The zone of anesthesia which I endeavor to reach—and it can usually be reached—is one in which the eyeballs are constantly moving and the corneal reflex is extremely brisk; it is sometimes possible to demonstrate the accuracy of Elsberg's statement that a condition can be produced in which the patient will open and close his eyes and give no evidence of pain sensation. The explanation of this phenomenon probably lies in the fact that artificial respiration is in itself an anesthetic measure; it may also be that there has been some diminution in the CO<sub>2</sub> content of the blood. It is certain that the minimum amount of anesthetic can be used and the fullest advantage taken of the narcotizing power of morphin. The anesthetic, too, can be blown out before the end of the operation and the patient sent off the table with full control of his reflexes. It has happened occasionally that following a difficult catheterization, blood has found its way into the trachea. No harm has resulted. The danger of this occurrence has been exaggerated. Provided that the material which invades the lungs is non-infective, and is small in amount, there need be little fear of septic pneumonia. We have here an additional argument in favor of appropriate doses of morphin combined with intratracheal ether. I have never seen any untoward effects, and the ward sister, who has had many of these patients under her charge, has not found it a disadvantage from the nursing point of view. Each case, of course, must be judged on its merits, and there should be hesitation in its use before full control of the intratracheal method has been acquired.

#### INTRATRACHEAL ETHER AND THE ABSENCE OF ASPIRATION PNEUMONIA.

The claim that intratracheal ether abolishes the risk of aspiration or septic pneumonia has been made good. No case has occurred in this series. Mr. Trotter has objected to the use of intratracheal ether for cancer of the tongue on the ground that



septic material from the growth may be conveyed by the direct laryngoscope to the upper opening of the larynx and thence aspirated into the lungs. This, if upheld, would be a fatal objection. But apart from the fact that this has not occurred on one single occasion, although many of these growths were large and ulcerating, it must be remembered that direct laryngoscopy gives a clear view of the whole field, the inner surface of the spatula is sterile, and the catheter can be inserted without contamination. Further, contact of the catheter with the tracheal mucous membrane usually brings into play its strong protective reflexes, or these reflexes can be quickly elicited. I think, then, that this objection falls to the ground but it emphasizes the importance of attention to detail. Whether the impossibility of aspiration of blood, or septic material, is due entirely to the force of the outgoing stream of air, is not clear to me; it is certainly true in the case of animals, where the pressure used is probably higher than that which I have used in the human subject. But, I believe, of almost equal importance with the pressure of the air-stream is the great decrease of inspiratory efforts; no air is drawn into the trachea during inspiration. The point is of practical as well as theoretical interest, for upon the answer depends the safety of the method for the semi-recumbent and upright postures.

#### ADVISABILITY OF INTERRUPTING THE AIR STREAM.

Another point arises here, viz., whether the interruptions in the air-stream at regular intervals are necessary or advantageous. Theoretically the result of the interruptions is that the lungs collapse slightly, drive out the  $\text{CO}_2$ -laden air, and at the moment of the resumption of insufflation receive a stream of fresh air. The gaseous interchange in the lungs is thereby promoted. In fact, the interruptions act as a sort of artificial respiration and thus add a factor of safety. Now a high pressure maintains the lungs in a state of distension, which impedes the venous flow to the heart. Interruptions, therefore, are necessary under these conditions but there is, I believe, less need for them when a moderate pressure is maintained, such as exists when the safety-valve blows off at 20 to 25 mm. Hg. In intraoral operations, again, it is probably wiser, if the field is septic or the hemorrhage free, to reduce the number of these interruptions; the same remark applies to cases of intestinal obstruction with vomiting, although, strictly speaking, they do not come within the scope of this paper.

The apparatus in common use in this country allow only of a partial reduction of the volume of the ingoing stream; whether this calls for modification

is uncertain. Some light is thrown upon this question by the experience gained in using this method on the human subject for purposes of artificial respiration. It is related of cases of this sort that the insufflation and the interruptions have had to be supplemented at intervals—whether long or short, regular or irregular, I do not know—by compression of the chest in order to overcome a gradually increasing cyanosis. Obviously a thorough interchange of gases could not be maintained. Samples of alveolar air taken from these cases would have proved of great interest.

Preference is expressed by some anesthetists for the foot bellows in place of the motor-blower, on the ground that they are in more intimate touch with the patient. Fischer uses a hand-pump as the pressure is not constant, but there is always a slight rhythmical fall of pressure at every movement of the lever, which favors a thorough interchange of gases. My own preference is for the motor-blower, for the very reason that the pressure of air and ether is constant and the control of the depth of anesthesia is more delicate. An objection to the foot-bellows in prolonged operations is that it becomes very wearisome; interest in the patient wanes. The longest time for which I have used it was three hours and twenty minutes; this was too long.

#### INCIDENCE OF BRONCHITIS.

A few cases have developed acute bronchitis, six in all, and these chiefly amongst the emphysematous and chronic bronchitic. This freedom from a somewhat serious complication is remarkable when the advanced age of many of the patients and the length of operation are taken into account. It is to be attributed to the use of atropin, the weakness of the vapor and its warmth. One patient developed bronchitis following lateral pharyngotomy for the removal of a carcinoma of the sinus pyriformis; the operation lasted two hours and six minutes. Later the sputum became foul, the lungs having become infected from a septic laryngeal wound. It is the opinion of the surgeon that infection was post-operative. No other case was severe or gave rise to any anxiety.

#### REDUCTION OF SHOCK.

One of the great merits of this method is that shock is reduced to a minimum. Intratracheal insufflation is essentially a method of artificial respiration. All the needs of respiration are met, and intermittent asphyxia is eliminated. It is, indeed, a luxurious method and calls for no effort on the part of the patient. There is, in consequence, a great saving of energy, which enables the most ex-



tensive operations to be undertaken with a high degree of confidence. There is, indeed, a danger that more may be attempted than is wise. The one-stage operation for cancer of the mouth may be a serious risk in a patient who has passed his sixtieth year, or even fiftieth, bearing in mind the habits and average condition of this group. It is of interest to note that this operation has been in my experience much less common in the last three years, and there has been a corresponding reduction in the mortality.

I have seen a severe degree of shock develop towards the end of the gland operation and pass off completely as soon as the skin flaps were brought together. Shock was here due to exposure and cooling. It is probable that the temperature of the operating room was too low. It has occurred usually in the small thin type of patient, and at first caused me some anxiety in those cases in which it had been decided to remove the primary growth at the same sitting. Experience, however, has taught me that a very considerable improvement can be looked for when the neck has been covered up, sufficient to allow of a safe completion of the operation.

#### MORTALITY.

No deaths occurred in Groups (I) or (II).

The mortality in Group (IIIa) was small, viz., two deaths out of forty-three cases. In one of these deaths was due, I believe, partly to mechanical difficulties but chiefly to the depressing effects of a large dose of morphin and scopolamin. These drugs had been given in error by a house-surgeon, and the breathing was with difficulty kept free when the catheter was removed. The patient died suddenly next day; post-mortem examination was negative except that the heart was small and fibroid. Death in the other case followed an extensive one-stage operation for a growth of the floor of the mouth; the man was an extremely unfavorable subject, flabby and a very heavy drinker, but his condition was so miserable that he was anxious to run any risk and preferred the small chance of a complete cure rather than a palliative operation.

In Group (IIIb) there were five deaths, one being due to pulmonary embolism the same evening. A boy aged 16 died the evening of operation from hemorrhage combined with shock after removal of the superior maxilla and the eye. Death occurred in two cases on the third day. In the first, an extensive operation had been performed for a growth of the tonsil, following removal of the glands a week previously; this had left the patient anemic. In the other, a feeble spare man aged 71, one-half of the mandible had been removed; the breathing

was not satisfactory unless the epiglottis and tongue were held forward with a finger, some blood was aspirated and tracheotomy was necessary. This case, and the case in Group (IIIa), emphasize the truth of Mr. Trotter's statement—a statement of the utmost importance to surgeon and anesthetist—that *"the shock of an attack of even partial asphyxia is very apt to be fatal in an enfeebled patient."* The benefits of intratracheal anesthesia can be thrown away in a few minutes. These fatalities were partly attributable to error of judgment and not to the method of administration: in the first, the operation should have been postponed; in the second, anesthesia was deeper than necessary when the catheter was withdrawn. Death occurred after removal of the superior maxilla in an old lady aged 80. She was a very healthy woman and was anxious to have the operation as she was suffering much from a rapidly growing tumor of the antrum. In order to lessen hemorrhage the external carotid was ligatured, but the vessel was tortuous and difficult to define. This half of the operation was done under C.E. and oxygen and lasted forty minutes. The second half, under intratracheal ether, proved also longer than anticipated, part of the soft palate being involved. The duration was forty-seven minutes. The condition of the patient at the end was good, the forehead warm, pulse 84, reflexes very brisk, but she gradually became weaker and died on the fourth day of exhaustion and basal pneumonia.

#### DISCUSSION.

Disadvantages urged against the intratracheal method, such as cost and bulk of apparatus, should carry no weight. A minor objection is the bubbling of blood and mucus in certain operations: much can be done to remedy this by efficient sponging, holding the jaw forward, the use of nasal tubes and other maneuvers. But no one of these disadvantages is of sufficient importance to justify the refusal to adopt a method which has been proved, both in America and in this country, to have so much real value. *In war surgery of the face and jaw it was indispensable, and it is a matter of regret that the neglect to use it more frequently led to the result that wounded soldiers lost their lives on the operating table.* It is not as if the method, or the conditions, were insuperably difficult. I fear the explanation must be that there were lacking a clear appreciation of the value of intratracheal ether and a close acquaintance with the technic. The taking of impressions, fitting and fixing of splints, wiring of the jaw—these are operations which are attended with much depression of the mandible and pushing



back of the tongue, frequently in the presence of suppuration. Here are conditions which favor aspiration-pneumonia and cardiac failure if the ordinary methods of anesthesia are used.

These dangers were, of course, recognized early and substitute methods adopted where possible. But none of them is as efficient or of such wide application as the intratracheal method. Crile's tubes have a limited field. Kühn's tube is bulky and impedes the operator, and as Mr. P. P. Cole has pointed out, "the effort of breathing through it is a physical strain that cannot be neglected." The reason is physiological. The tube is long and of small bore; oxygenation is deficient and rebreathing excessive. Chloroform and oxygen in the upright position is not a safe method except in the hands of the expert, and even then may give cause for considerable anxiety. Opening the windpipe is seldom if ever indicated in military surgery. if, indeed, it is always possible. I remember a case, in the early days of the war, of an officer suffering from a fractured mandible, much neglected and very septic, with a septic condition of the skin of the neck. Laryngotomy or tracheotomy was out of the question, and it was doubtful whether intratracheal ether could be used in such a dirty condition of the mouth. It was, however, quite successful, and similar cases were anesthetized throughout the war without any complication arising. If due care be taken in passing the catheter no septic material can be carried down with it.

Puncture-laryngotomy was used on a few occasions by Mr. P. P. Cole, at King George Hospital, and was abandoned at the request of the patients, who complained that the wound was painful and prolonged their stay in bed; their neighbors, who had had intratracheal ether, were able to get up sooner.

The question arises whether the administration of the anesthetic through a laryngotomy or tracheotomy tube is a better method in cancer of the mouth than intratracheal ether. It has been said that cancer cells may be implanted further down the air passages by the introduction of the direct laryngoscope. This is a difficult matter to prove, and hardly comes within the province of the anesthetist. The danger, however, cannot be overlooked, and it would seem that if contact with the growth cannot be avoided—e. g., in cases where the growth is large, and is situated in the mid-line, the advisability of opening the windpipe should be seriously considered. My experience of this type of growth is small and information on the point is welcomed. Information is also wanted on the relative mortality of the

two methods. It may be taken for granted that aspiration pneumonia is not a cause of death in either. It will be seen from the results in Group (III) that the death-rate from shock is low, but here again the figures may be misleading, for the epiglaryngeal and hypopharyngeal cases are relatively few in number. From the point of view of the anesthetist, chloroform is not such a good anesthetic as ether for extensive and prolonged operations. It is too depressing. Ether, on the other hand, especially when given by modern methods, is known to be capable of sustaining the blood-pressure over long periods and to have rid itself of its former reputation of setting up irritation of the lungs. The results that have been obtained in other fields of surgery favor the use of ether, and I believe that the figures given in this paper show that chloroform has received another set-back. I would submit, then, that the intratracheal insufflation of ether is a very valuable method in intra-oral surgery, can be used with confidence in the young and the old, has abolished the risk of aspiration-pneumonia, and has much reduced the mortality.

61 QUEEN ANN ST. W.

## Book Reviews

### Backwaters of Lethe: Some Anesthetic Notions.

By G. A. H. BARTON, M. D., Anesthetist to the Hampstead General and Royal National Orthopedic Hospitals. Cr. 8 vo., pp. 151; 11 illustrations, including 2 plates. H. K. LEWIS & Co., LTD., Publishers, London, 1920.

Barton's fragmentary essays are the outcome of 20 years' practice and study of anesthetics in about half as many general and special hospitals. Recent experience in teaching the art has familiarized the author with the pitfalls that beset the path of the neophyte; many of which are of his own digging and many due to lack of appreciation of simple mechanical details. In so far as they offer hints to beginners, Barton's essays crystalize the results of his experience. Dealing as they do with small practical matters—too small to take up much space in the text books—Barton hopes they may have some value in adding to the craftsmanship of the specialty. Barton's book is delightfully written for he questions with Leonard Williams: "Why medicine should be dull as well as difficult?"

After devoting his opening chapter to the anesthetist and his relation to his specialty and equipment, Barton discusses some interesting points on chloroform and details at length the use and abuse of alkaloids in anesthesia. Favoring the routine use of an ethyl chlorid-ether sequence Barton explains his personal technic and apparatus. Various newer methods of anesthesia, still on trial, are briefly dealt with and Barton concludes his volume with some valuable data on the shoals and rapids of anesthesia as he has personally encountered and conquered them.

(Continued on page 31)



DOSIMETRIC CHLOROFORM AND ETHER  
VAPOR ANESTHESIA: SOME REFLEC-  
TIONS OF A SICK ANESTHETIST.\*

T. W. HIRSCH, M.D.,

Temporary Captain Royal Army Medical Corps.

LONDON, ENGLAND.

I had hoped to have the advantage of attending your most important meeting. Instead, however, of a deep but impartial interest in the subject of anesthetics, *I have unfortunately had five personal tastes of my own smoke*, thus my inability to hear your papers and discussions, which I deeply regret.

The advantages of having had an anesthetic oneself, makes even an anesthetist regard the subject from another aspect, *the patient's point of view*. I now consider that worthy of great attention.

We might all with advantage bear in mind Voltaire's remark: "*Je suis assey semblable aux girouilles, qui ne se fixent que quand elles sont rouillées.*"

We are indeed like straws upon a stream, some steered by wind and current sailing free, others caught by eddies and swung round and round, tossed perhaps in drift heaps, there to remain. Meetings such as yours, by mutual intercourse and stimulation, enable us to ride down the narrow rapids and gain the wider way and thus advance the science of our "*Beloved Sleep*." Our motto can thus indeed be: "*Me duce, tutos eris.*" Kismet should have no place in our vocabulary. Nor will it if the administration of anesthetics is only undertaken by medical men, who like you, have specialized in the subject.

It is argued that doctors order medicines, but they do not administer the dose themselves. With the inference that the operator orders chloroform or ether and it can be dropped on a bit of gauze held over the patient's face by anyone under his direction. There may be surgeons who still desire to be chief of the anesthetic as well as of the operating field, but they must be few. So few that the argument falls. The tendency is to give deservedly high credit to our craft.

It is said that a motorist has three speeds—*viz*, that which he tells the police he drives at; the one he mentions to his friends, and that which he really drives at. So with us the method is the one the surgeon remarks on, the one the patient comments about on the following day and lastly that which the administrator imagines he himself is employing.

These three like the automobilist's speeds do not always coincide! We are like pianos, the tune may be others, but the tone its own. Our methods may be common to many, but the results vary with the individual administrator.

## THE METHOD OF CHOICE.

Our object is a quiet induction, an absence of all cyanosis and postanesthetic sickness together with safety to the patient and the relaxation the surgeon needs.

The method and drug which give these results is the ideal combination.

The choice of an anesthetic and method calls for the exercise of discrimination and judgment. Both in military and civil work it depends on the patient's condition and the nature of the operation.

Nitrous oxid oxygen with occasional bubbling through ether, as used with such success by Gwathmey and others in your country is excellent. I say this feelingly as I had two such anesthetics myself. The relaxation without nerve blocking, however, is not sufficient for some surgeons. Undoubtedly then, *if the patient is not septic*, chloroform, if properly given, is ideal. Have I dropped a bomb-shell? Do I raise a storm of protest? I expect it as I want to add this raisin to the dough of your deliberations.

Providing there is an absence of sepsis—meaning that the danger of acidosis is eliminated, my personal and individual experience bears out what I claim for chloroform. When I had ether anesthesia on two recent occasions, each for over two hours, I was sick and in misery for a week after. With chloroform this is an exceptional sequel. I thus sympathize with the many ether sufferers, and hence my endeavors to relieve them by advocating and using chloroform, when it can be given with safety. This many will deny. I have given some 10,000 chloroform anesthetics without a death, although I have had three deaths under ether. Good! you will remark and advise me to touch my head and hope my luck may continue, though you doubt it.

I wish to emphasize the importance of a *gradual induction* and the use of a *mouth airway* and, if needed, a *nose airway* as well; thus *slipping back of the tongue* and the one great danger—*respiratory trouble* are prevented. Some like the ordinary mask and drop bottle. I prefer the greater ease of a percentage inhaler. The following is a description of the one I have previously described and used with uniform success for some years.

\*Read by Title during the Sixth Annual Meeting of the Interstate Association of Anesthetists, William Penn Hotel, Pittsburgh, October 5, 1920.



AN IMPROVED SIMPLE PERCENTAGE CHLOROFORM  
INHALER.

As the illustration shows, the apparatus consists of a metal cylinder divided by a thin domed false bottom into two chambers. The lower one is coned to take an ordinary gas face-piece, and is provided with a movable angle connection for use when the patient is on his side or face. Various pieces are made with different angles so that the chloroform container can be kept fairly vertical,

surrounded by an air cone which is expanded below over the false bottom in a baffle plate, so as to distribute the air equally over the anesthetic. A by-pass passes from the upper chamber through the cone and projects into the air tube. The air cone is provided with an opening or port, admitting air to the upper or chloroform chamber. The size of the port is regulated by a movable collar on the lid, and an indicator shows the percentage of chloroform which is passing to the face-piece. The upper chamber is surrounded inside with a wick, and also has a wick round the inner cone. Both wicks touch the bottom of the upper chamber, the latter one by passing through a hole in the baffle plate. The lid is removable, but to save taking it off during the administration of the anesthetic, a screw-on cap in the lid permits the addition of chloroform to the upper chamber. The wicks can be removed, and the whole apparatus sterilized, after which, of course, it must be thoroughly dried before the wicks are replaced.

## METHOD OF USE.

To use the inhaler, twelve drams of chloroform are placed in the upper chamber, which saturates both wicks and leaves a layer on the false bottom below the baffle plate, but not touching it. Care must be taken that the chloroform does not reach as high as the baffle plate, otherwise the apparatus will not work correctly. The indicator is put to zero (port closed). An ordinary gas face-piece is attached to the coned end, either directly if the patient is on his back, or if in another position by means of one of the angle pieces. The face-piece is then adjusted to the patient's face, so that the only admission of air is by the air tube. Pure air is then breathed. As the port is opened chloroform vapor is drawn through the by-pass in the same way as air is sucked into a Bunsen burner or a Fletcher gas stove. The expirations of the patient maintain a constant temperature in the chloroform chamber, and from actual experiments at that temperature the dial on the lid is graduated to show the percentage being inhaled. In use it is found advisable to start with the port closed, indicator at zero, and to take ten to fifteen minutes in passing gradually to 2.5 per cent., when surgical anesthesia is generally produced. A higher percentage is rarely needed. Anesthesia, when obtained, can be maintained at from one to two per cent., especially if one-twelfth of morphin and a hundredth grain of atropin are given twenty minutes prior to the induction. With this preliminary narcotic and a slow induction the struggling stage is nearly always eliminated even with robust soldiers. The only important point is

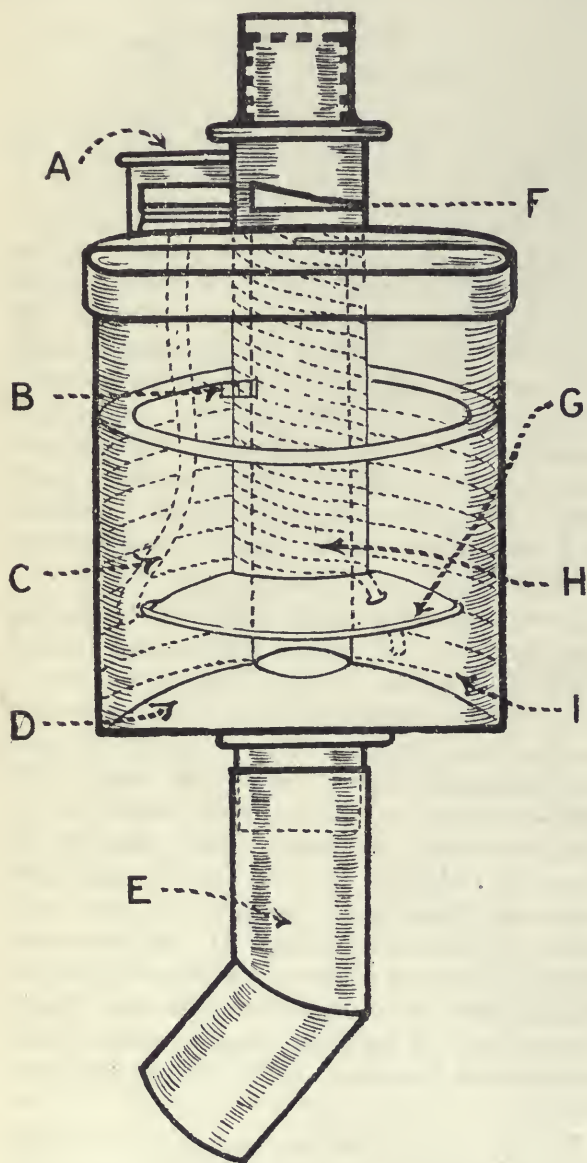


Fig 1—(a) inlet for chloroform addition; (b) chloroform by-pass to air chamber; (c) chloroform tube; (d) hollow dome; (e) detachable tubing for fixing to respirator; (f) port or air inlet; (g) baffle plate; (h) absorbent wick for chloroform around central cone; (i) absorbent wick around walls of chamber.

irrespective of the patient's position. A central tube passes through the lid and upper chamber, terminating in the false bottom, and conveys air directly to the face-piece. This central tube is

to make a gas-tight joint between the face and inhaler, which can always be obtained by the use of an appropriate sized face-piece. I recommend Barth's. Face-pieces are not included with the inhaler. I strongly recommend after induction the introduction of an air way; it ensures a free supply of air and prevents slipping back of the tongue.

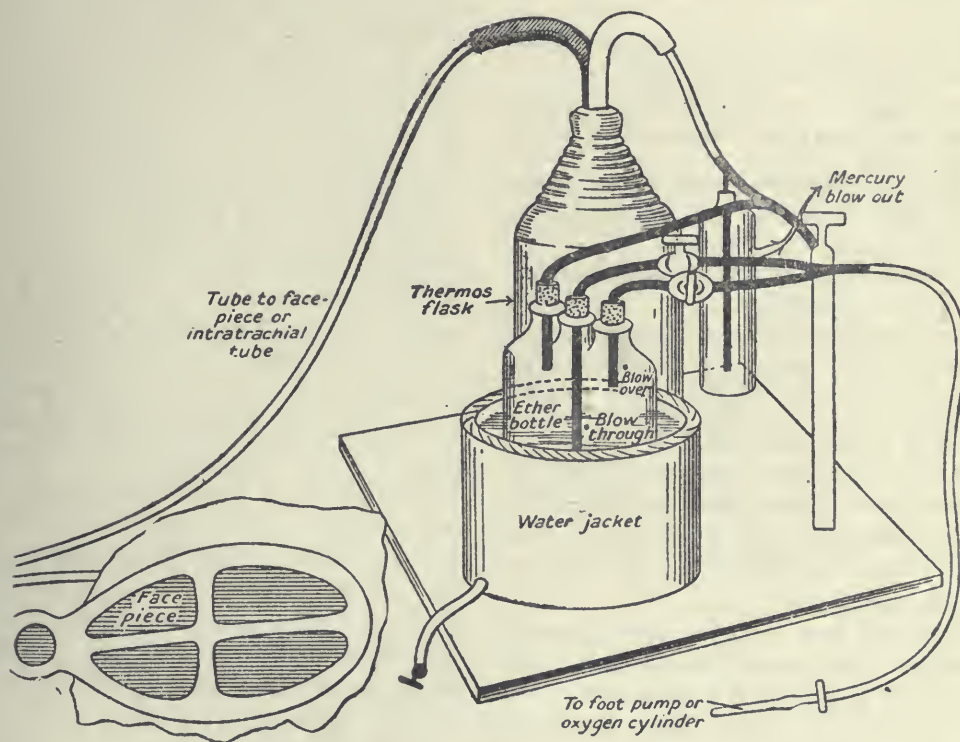
Oxygen can be given at the same time by slipping a pewter tube connected with an oxygen cylinder into the air-tube. In certain cases this has many advantages, especially if the gas is warmed.

After induction with chloroform, ether can be

pump or hand bellows. It is then warmed by passing through a copper coil in a thermos flask containing boiling water, or to save the trouble of using the bellows, oxygen, from a cylinder with a fine adjustment valve, can be used.

As the illustration shows, if a detachable mercury blow-out is added, it then forms an ideal device for intratracheal administration. By closing two taps, the ether is cut-off and air or oxygen is available for a plus lung pressure. In tonsil dissection cases, the vapor, after induction, is continued through the nose.

Safety lies in attention to such details as the



substituted and anesthesia thus maintained. With the indicator at full, over ten per cent. is obtained; if a higher percentage is needed four layers of gauze can be attached to the air tube and additional ether dropped on. A special frame is provided for this purpose. By this means any depth of ether anesthesia can be obtained.

After use the air tube and chamber should be cleaned with sterile gauze.

#### ANESTHETIC POINTERS.

When chloroform is contraindicated, as in thyroid operations and deep anesthesia for tonsil dissections, warmed ether vapor is ideal. For this purpose I use a three-neck Wolf bottle. Air can thus be pumped over or through the ether, by a foot-

proper preparation of the patient, a preliminary narcotic, a gradual, slow induction, the maintenance of a patent air-way, uniformity of anesthesia dosage and anesthesia.

With these principles in our mind our motto can indeed be: "*Me duce, tutus cris.*"

Like the parson with his sermon, there is always the most important matter to divulge as soon as the last word is given. It is to wish my American colleagues God-speed and success in their labors. I am looking forward to reading your papers and discussions and the enlightenment that they will, I know, shed on the current advances and more routine practices of our specialty.

40A, HYDE PARK GATE, S. W.



# American Journal of Surgery

## QUARTERLY SUPPLEMENT of ANESTHESIA and ANALGESIA

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Avon Lake, Ohio, U.S.A.

JANUARY EDITORIALS 1921

### NEW (KENTUCKY) PRACTICE LAW FOR ANESTHETISTS, DRUGLESS CULTS AND OPTOMETRISTS.

The following is reprinted from the *Kentucky Medical Journal*, May, 1920, to keep readers of The Supplement informed regarding legislation in relation to the specialty of anesthesia and the status of the professional anesthetist.

This new practice law was introduced in the House by Hon. J. T. Stites, of Paducah, and in the Senate by Hon. W. L. Moss, of Pineville, Ky.

It remains to be seen how the State Board of Health will be able to make the new practice act serve the purpose of protecting the public as well as the profession.

"An Act relating to the State Board of Health, further defining and regulating the practice of the healing art and of optometry and of all other limited systems of practice in this State; relating to applications, examinations and certificates, and to fees therefor; and providing for representation in such examinations of the various schools and systems of diagnosing and treating human ailments, and of optometry, and providing penalties. Be it enacted by the General Assembly of the Commonwealth of Kentucky:

1. That the State Board of Health shall, upon application of the Kentucky Association of Optometrists, in respect to the practice of optometry and

of any State association composed of practitioners of any drugless or limited school or system diagnosing or treating human ailments, defects or deformities, now in existence or which may hereafter be devised, legally chartered under the laws of this Commonwealth, from a list of seven of its members selected and certified to said Board by such association as persons of good moral character and graduates of a reputable college of such system of practice, appoint three assistant examiners for each such school or system to represent each of said groups in the examination of its applicants by preparing all questions and grading all papers involving methods or principles of diagnosis, treatment, adjustment, cure or relief of patients, and by the assistant examiners in optometry in the practice of optometry, and who may be present at any meeting when such grades are considered, which grades shall be accepted by the Board and considered with the grades made in anatomy, physiology and pathology prescribed and required by the Board to test the qualifications of applicants from all schools or systems to practice with safety to the sick and afflicted, and the Board shall issue certificates to all applicants who make the grades required by existing law, provided that applicants may be examined in all subjects in which they have been trained and may practice the branches in which they are found qualified. The Board shall have authority to hold separate examinations for the different schools, or systems of practice, or groups of them or for optometrists, as it may deem best, and may, in so far as in its judgment may be consistent with the safety of the sick and afflicted, limit the examination in anatomy, physiology, pathology and other subjects to special regions or parts of the body, and in its certificates it shall limit the treatment and work of such applicants to the method of practice in which they have been trained and found qualified. All examinations shall be secret and in all matters as to standards of education or reputability and as to questions and grades shall be governed and conducted as provided by law and by rules and regulations of the Board not inconsistent therewith.

2. That applicants may present their credentials by mail or proxy upon forms furnished by the Board. All certificates shall be signed by the president and secretary and attested by the seal of the Board. The fee for each certificate, including the examination, shall not exceed the sum of twenty-five dollars, which is hereby fixed as the fee to be paid by all applicants, and all of such fees shall be paid into the State treasury and kept



as a separate fund and used for paying the expenses of the administration and enforcement of this act and of chapter eighty-five, Kentucky Statutes, and shall be accounted for as required by law for other funds and expenses of the Board.

3. That any person who was reputably engaged in the practice of anesthesia, chiropractics, chiropody or other systems of drugless healing, or optometry, or any other limited system or special branch of practice in this Commonwealth on or before January, the first, one thousand nine hundred and twenty, who is endorsed as competent and reputable by the assistant examiners for the school or system which he professes to practice, or in respect to an optometrist by the assistant examiners in optometry, and who makes application to the Board within ninety days after this Act goes into effect, accompanied by the fee, shall receive a certificate without examination. All certificates, issued under the provisions of law by the State Board of Health when registered in the office of the county clerk of the county in which the holder of such certificate resides, shall authorize the holder to practice the system of healing named in such certificate, subject to all of the conditions imposed upon the holders of all certificates heretofore issued, or hereafter to be issued under the law.

4. That any person living in this State or who may hereafter come into this State who administers anesthetics or practices or attempts to practice any system of diagnosis or healing now in existence or which may hereafter be devised, or who corrects defects of the eye or other parts of the human body by mechanical or other means, except upon the prescription of a legally qualified physician, or in any way performs the duties usually performed by physicians, without having complied with the provisions of law, or who opens an office for such purpose or announces to the public a readiness to so practice, shall, upon conviction, be subject to all of the penalties provided in section two thousand six hundred and eighteen, chapter eighty-five of the Kentucky Statutes; provided this Act shall not apply to persons who sell trusses, spectacles, eyeglasses, or lenses only as merchandise in a duly established mercantile establishment; provided further, that this act shall not apply to the practice of Christian Science; provided further that this Act shall not apply to the practice of dentistry."

#### THE STEPS TO ANNIHILATION.

At the present time the following system is being used by certain anesthetists, surgeons and hospitals to put the specialty of anesthesia into the discard. Anesthetists, occasionally of their own accord, but

more often under threat of losing their staff positions and private work are training nurses to give anesthetics. As soon as the nurses are partly trained the surgeons or hospitals demand that the anesthetist accept a salary for his work that is so negligible that he must refuse it if he wishes to maintain an ethical and social standing on a parity with others of the profession in his community. Forced to retire he is replaced by the nurses he has trained and while they receive the most nominal of salaries the surgeons and hospitals charge patients the usual professional anesthetic fees and pocket the profits.

Do not any longer allow yourself to become a victim of the commercial exploitation of such surgeons and hospitals. If this game of *freeze-out* is tried on you take the matter to your local Academy and State Society, as well as to your Chamber of Commerce and the Public Press and give all those involved in this pernicious practice the professional and community publicity they deserve.

Under no circumstances allow yourself to be placed on a salary. The profession of medicine is based ethically on professional fees commensurate with the value of the services rendered and those who are seeking to place physicians and specialists on salary want to socialize the practice of medicine.

There was no more necessity of training nurses to give anesthetics during the war than there is now. For months on end those in authority compelled the wounded doughboys to accept incompetent anesthesia at the hands of two-weeks trained nurses, when the national and international experts in anesthesia were being denied commissions for anesthetic service and when 1,200 women physicians and hundreds of experienced dentists stood ready to perfect themselves in the refinements of anesthesia, in the routine administration of which they were already proficient.

The same false leaders, who plunged nurses into anesthetic service in the war, are continuing their efforts to place the specialty of anesthesia in every city of the country on the dead level of mediocrity of a nurse's competence. The movement is just the same as if the specialty of obstetrics were being handed over by its leaders to midwives.

The only way to stop this annihilation of the specialty is to stop training nurses, refuse to go on salary and stand foursquare for the safety of patients, the advancement of your specialty and your professional prerogatives.—McM.

IT IS VERY DIFFICULT FOR THE SECRETARY OF ANY ASSOCIATION OF ANESTHETISTS TO CONTINUE ORGANIZING INTERESTING PROGRAMS FOR MEETINGS WITHOUT THE CO-OPERATION OF THOSE WHO ARE MAKING RESEARCHES IN THE PHARMACOPHYSIO-PATHOLOGY OF ANESTHESIA OR ADVANCES IN THE TECHNIC OF ADMINISTRATION. IF YOU HAVE ANYTHING OF INTEREST TO PRESENT DO NOT HESITATE TO GET IN TOUCH WITH EDITOR OF THE SUPPLEMENT AND HE WILL SEE THAT YOU ARE PLACED ON A PROGRAM AND THAT YOUR PAPER WILL RECEIVE DUE PUBLICITY.



# ANESTHESIA IN WAR SURGERY

## PROVIDENCE SOCIETY OF ANESTHETISTS.

The following is an editorial abstract of a paper and its discussion presented before a Joint Meeting of the Providence Medical Association and the Providence Society of Anesthetists, December 1, 1919. From the Rhode Island Medical Journal, March, 1920:

## THE ANESTHETIC PROBLEM IN LUNG SURGERY.\*

JAMES T. GWATHMEY, M.D.,  
NEW YORK, N. Y.

This paper is based upon between eighty and one hundred animal experiments performed in the Central Medical Department Laboratories, A. E. F., Dijon, France, and a large clinical experience with surgical teams working in the advanced zone of the American Army and confining themselves almost exclusively to chest surgery.

Both the anesthetic and the method to be employed were thoroughly tried out and finally decided upon before they were employed in the surgical work at the front.

The anesthetic agent to be employed in lung surgery should be one that, other things being equal, sustains the blood at the highest level consistent with good surgical anesthesia during the operation and with a minimum of reaction afterward. By process of elimination the choice lay between ether and nitrous oxid and oxygen, both of which were employed in the animal experiments. The final decision rested upon nitrous oxid and oxygen as the agent most nearly meeting the requirements.

### THE POSITIVE PRESSURE METHOD.

The positive pressure method finally selected, after eliminating the endo-tracheal and endo-pharyngeal methods, involved the use of an air-tight mask (with a rubber bag reservoir, close to the mask, for the gases) placed upon the patient's face. A pressure of from five to twelve millimeters of mercury had already been determined upon as a result of the animal experiments. The positive pressure method used provides for: (A) A constant supply of fresh gases; (B) a constant escape of some of the bases; (C) a slight amount of rebreathing. The escape of the gases may be through an expiratory valve, although a valve is not absolutely essential, since the mask may be held in such a manner that a constant leakage occurs. No air can possibly enter the apparatus at any time when positive pressure is sustained. *A slight positive pressure in addition to the gases is unquestionably an important factor in maintaining anesthesia. In addition to being an aid in maintaining anesthesia, positive pressure in lung surgery is a great aid to the surgeon, facilitating the examination of the lung, making the operation easier, eliminating the necessity for dangerous traction, giving satisfactory hemostasis, and obviating the need of undue haste.*

The Army apparatus for administering nitrous oxid and oxygen is so simplified and so inexpensive that it may be universally used not only for lung surgery but for other operations as well.

### REQUISITE DEPTH OF ANESTHESIA AND OXYGENATION.

It was found, from the animal experiments, that full surgical anesthesia that is safe without preliminary medication, is unsafe with this medication. For this reason the technic gradually merged from a deep to a light anesthesia, and finally to analgesia with unconsciousness. The high percentage of oxygen (15 to 35 per cent.) used, in connection with other obvious symptoms, would seem to prove that analgesia and not anesthesia is present. It occasionally happened, in the earlier work, that when too much oxygen was given, all physiological requirements were met and breathing ceased temporarily, for a half or three-quarters of a minute, the pulse continuing as before, and the patient having a pink color. This temporary cessation may be obviated by (1) decreasing the positive pres-

sure momentarily, (2) allowing air to enter the mask, or (3) slightly increasing the amount of nitrous oxid. By using any one of these methods the breathing will continue normally.

### TECHNIC OF ADMINISTRATION.

The technic employed in all chest cases calls for the administration of one-quarter, three-eighths, or one-half grain of morphin, usually three-eighths, hypodermatically, forty to sixty minutes before operation. Rapid or labored breathing, sometimes an important harmful factor in chest cases, is thus eliminated, and the patient comes to the table in the best possible condition. To begin with, just enough of the anesthetic agent is used to maintain analgesia, with the Army apparatus, two holes of oxygen and six of nitrous oxid. The mask is held tightly on the face, and the first three or four exhalations are allowed to escape through the expiratory valve, after which the valve is turned off, and part of each exhalation is allowed to escape between face mask and face. The rubber bag is filled to plus pressure. When the skin incision is made, if there is no movement or indication of pain, the oxygen is increased to three holes, the nitrous oxid remaining the same. The patient has a pink color, the lid reflex is active, the eye rolling, yet the muscles are well relaxed. From this time on any further increase in oxygen is determined by the condition of the patient. If the patient has been gassed or is still bleeding, equal proportions of the gases may be used, or, in some instances, 75 per cent. of oxygen and 25 per cent. of nitrous oxid, positive pressure being maintained in all instances. In every case full oxygen is given as the last stitches are inserted. The patient now has a very pink color, with pulse and respiration so nearly normal that this true condition may be almost entirely masked. He should be treated in every instance as a shocked patient—a point which should be clearly emphasized.

This combination of the highest safe physiological dose of morphin, reinforced by nitrous oxid given with the highest possible percentage of oxygen, as stated above, with positive pressure, given in the easiest and simplest way, results in the safest and most satisfactory narcosis available today for lung surgery. When the plan here outlined is followed, the patient rests quietly throughout, and rarely moves or utters a sound.

### DISCUSSION.

DR. P. E. TRUESDALE, Fall River, Mass.—There are two classes of cases that must be considered whenever we talk about chest surgery. One is the type we see in civil practice, the chronic empyema, and the other type we saw in war—those suffering from hemorrhage, shock and perforation of the viscus.

In France I saw not a very large number but quite a good number of chest injuries. In the autumn of 1917 I had the good fortune to go on the French front to a French evacuation hospital. There were at that hospital three surgeons, Drs. B. Marquis, Pierre Duval and Hartman Cross, who did base operating there, so that the best men in France were operating at that hospital. Pierre Duval was doing chest surgery and he made his incision over the fourth rib whether the injury was in the back or front. He always went into the same place with his cautery, excising four or five inches of the rib, and with his French self-retained retractors opened the rib widely throughout the lung and searched for the foreign body, usually finding it; wiped out the chest cavity with ether and closed it up tight. He did that always in twenty minutes. It is safe to say that the period of time clapsing from when he had first found and operated upon the lung was scarcely more than five minutes. There were two other surgeons in that hospital who occasionally did chest operations, Drs. Cross and Marquis. They were very skillful men but were very deliberate and took considerable time in chest operations. Neither one of them would finish an operation for the removal of a shell fragment in the lung in less than an hour. *Their mortality was between thirty and forty per cent.*

In that drive in October Pierre Duval operated on fourteen cases and lost one patient. They remained there two weeks, and one patient died. *In general his mortality was fifteen per cent., and when we realize that the mortality*



*in chest cases in general was twenty-five per cent. in the advanced dressing stations and an average of twenty per cent. in the evacuation hospitals and ten per cent. in the mobile hospitals, making altogether a mortality of fifty-five per cent. of chest cases from the time they were picked up on the field until they reached home, you can see that Pierre Duval's mortality was below that of any other of the average surgeon who was doing chest surgery. He had the same anesthetist and always gave ether, never giving morphia or any other drug before the operation.*

I talked to him about the different anesthetics and about the administration of drugs before operations, and he said that on some cases the year before he had tried out the various methods and had come to the conclusion that it was safer not to give the patient morphia or any other drug before ether. An expert anesthetist gives the minimum amount of ether and he completes the operation in the minimum amount of time, and I believe that is the secret of his success.

These chest patients who were brought into the mobile hospitals were nearly all in a state of shock, and that shock might be due to the injury itself or to hemorrhage, and it was often times very difficult to discriminate; sometimes it was impossible. If it was due to shock and an operation was done, it made no difference whether he used gas-oxygen or anything else. The patient died. But if the shock was due to hemorrhage that was continuing and you waited, the wounded man died, and if you operated in all probability you could save him, so that it was necessary to decide in the first place whether the wounded man was suffering from shock and whether the shock was due to hemorrhage that was continuing. If he had a sucking wound in the chest we knew that he was suffering from hemorrhage, and if we closed the sucking wound he would very probably get well because then the thoracic pressure would stop the hemorrhage. If a man was wounded by a bullet, which was usually a through and through wound with the orifice of entrance and exit closed and the site of the chest pretty well filled, we did not operate because we felt reasonably sure that ultimately the pressure and clotting that occurred in the chest would close it unless it happened to be in the upper part of the lung and in front; then the man could spit blood from the wound itself. If there was a considerable pressure against the heart on the left side, then operation was indicated just as if he had a sucking wound and the operation done to control bleeding. In all of these cases it required a finesse of judgment, and those of us who had the opportunity to see Pierre Duval had a real good start in introductory work on the chest.

You could not help seeing the points, which gave one the impression that after all ether was a pretty skillful form of anesthesia if administered properly and that morphia was a dangerous drug. If a man came in with a sucking wound and had a blood pressure of eighty, he had one-quarter grain of morphia given perhaps in the advanced dressing station, one-quarter of a grain of morphia given in the mobile hospital, and died quietly. If a man did not have morphia and was dying with hemorrhage, occasionally then perhaps we saved him because he did not have morphia. These were measures, of course, used in the war. If a man had received a bullet through the lung, or was struck in the chest, and had a penetrating wound of the lung, and was taken to the hospital and given one-quarter of a grain of morphia at once, it was difficult to know what to do. Let alone, the surgeon can decide what it is best to do for him. On the other hand, if it is a case of empyema, we know that in the acute case, if we decide to operate, the quickest operation possible is to be done. If you could eliminate all influence of shock and anesthesia, this is unquestionably most desirable.

A good many surgeons, who have come home from France, have expressed their disappointment with the small amount of surgical knowledge we have obtained from war experiences. There have been comparatively few contributions that have been really instructive during the war. As a matter of fact, surgery had a little setback because before war was declared a great many pressing and immediate problems were being worked out which were abandoned, and now that the war is over it does not

seem that the average man is as ready to dig for knowledge as he used to be. But when you consider that England was in the war four years, that French surgeons were in the war four years, and that the French surgeon, who was usually a lieutenant, but sometimes a captain, was usually allotted a matter of three hundred and fifty francs per month, and living in that way for four years, one can readily understand that the spirit of progress in the minds of these men is in the direction of more pay and shorter hours. It has reached the office, the operating room, and the lecture room just the same as it has gone into the factories, the railroads and the mines. There are mighty few fellows who want to go back on that slate. I feel tonight like congratulating Dr. Gwathmey for getting out of the war, not only with having done something really instructive, but with a spirit that will continue in this work of research with anesthetics.

DR. ALBERT L. MILLER, Providence, R. I.—I think that this society is very fortunate in hearing anyone so well informed on the subject connected with anesthesia, and especially that connected with the chest. We all of us see lung surgery, sometimes with the same experience these men have had, and I think we have a lot of excellent experience in this line, too. And then again because Dr. Gwathmey from his tremendous experience has held to knowledge that he has gained during the war, and has taught us a great deal of real value.

I am especially interested in what he had to say and what Dr. Truesdale has said about light anesthesia in these cases, because it has been generally supposed and is rather an abstract in the mind of the profession at the present time that shock is likely to occur under light anesthesia, and it is necessary to give either gas-oxygen or ether in order that there may not be shock. Recently it has been proven that shock never occurs as the result of light anesthesia and that it is impossible to anesthetize a patient so lightly that as a result there may be shock, but rather that shock results from deep anesthesia. I think that it is especially noteworthy in Dr. Gwathmey's paper where his comparison of gas-oxygen anesthesia and that which he uses as light anesthesia appears and with which he does not find shock.

There are some other features which should be outlined for the operation under anesthesia. I think that after we decide what anesthetic we should use that we ought to pay attention to the posture of the patient. There is a great deal of damage done in these cases, especially when the patient is placed in a sitting position or when rolled on to sound lungs. The operation performed in the sitting position tends to put the patient in a condition of shock, and if the patient is rolled over at all on to a sound lung he immediately has the dyspnea increased and considerable extra weight on the heart. In some cases these patients may have a dilatation of the heart result from the great stress that was put on it from this cause. I believe that it would be better if we should establish a principle and never put the patients under anesthesia in a position which they are not able to assume except with a considerable degree of comfort. I would like to ask Dr. Gwathmey his opinion of such cases.

I was interested in the gradual removal of positive pressure of permanent cases. It sometimes seems, after an operation of half an hour or so, that having this pressure removed at the end of the operation rather suddenly that the patient would lose a great deal of benefit that should come from positive pressure. I would like to have Dr. Gwathmey tell us how gradually he was used to removing the positive pressure.

DR. JOHN W. KEEFE, Providence, R. I.—It has been my privilege to see Dr. Gwathmey give anesthesia in New York on several occasions, and I oftentimes wished we could have him at the hospital to help us regularly. I feel that the interest taken by the societies of anesthetists has already done a wonderful amount of good.

Perhaps the drop method of giving anesthesia is the method that is used to anesthetize a very large number of patients today. The gas-oxygen method might be of value to a considerable number of people because it is absolutely easier to have an apparatus on many occasions, so if these men would study this other method as well so that they



could commence to carry out the benefit of their experience with this method of giving gas-oxygen in the lung surgery cases it might help a good deal. It would seem that there are times when it may be impossible to prevent trouble with this method. Your patient may become so debilitated that perhaps anesthesia may be impossible and that you may have to take off your mask. Then again you may have vomiting while the operation is going on, necessitating taking off the mask and again interfering with your operation. Most of the cases of empyema, to my mind, have been done with local anesthesia. There we have made scarcely any progress, and the fact that you can give the patient morphia previously and then use local anesthesia seems to be the most desirable. For some cases of abscesses of the lungs we merely will have to find some other form of anesthesia, and no doubt the gas-oxygen method is the ideal method. Happily there are few cases of this type of operation that the average surgeon may have to deal with. Some men, making a special study of lung construction, will have special apparatus such as Meyer has developed in New York City.

I want to congratulate Dr. Gwathmey on his coming here with us, and also Dr. Truesdale, and I feel that the stimulation which these men have given to men who are doing surgery is going to be of unlimited value in the future.

DR. WILLIAM B. CUTTS, Providence, R. I.—My experience in lung surgery was very intensive and very short so far as any extensive experience goes. As a general surgeon, I suppose I have seen some of the ordinary lung cases that come into the general hospital—that is an occasional abscess and the empyemata.

About a year ago at this time, or a little earlier, following an epidemic of pneumonia in the United States Army General Hospital No. 2 in Baltimore, it was my duty to operate upon sixty cases, in three weeks, of acute empyema following the pneumonia epidemic that was raging all over the country. Some of those cases were operated upon at an early stage following the pneumonia and it was found in all of those cases where operation was done early before the empyema had had time to become localized and before pus had formed that the operation did not give relief, and that the patients all practically died. I was at that time Chief Operator under direction of a Major General, and we were instructed to use our own judgment. Those cases, of course, we operated upon without anesthesia, except local. Novocain was used at that time. A short time later the cases that had developed a real empyema came to the attention of the surgical service and as I say something over fifty cases, or perhaps about sixty in all, were operated upon in a short time. Some of those cases that were in extremely critical condition with very rapid pulse, giving a warning of pus, and showing a temperature, were in septic condition. We operated simply by a puncture. All of those cases so operated were living when I was discharged from the army, and some were practically well. The other cases that were not extremely sick were operated upon by making a resection of one of the ribs, usually the eighth or ninth. A few of those were operated upon under novocain local anesthesia. Those patients complained bitterly of the pain at the time of the operation in spite of the most careful use of novocain. It was impossible to resect the rib without causing pain. Some patients do not complain very much but stand a good deal of pain. It is impossible to anesthetize the tissues underneath the rib by any local anesthesia. Following that experience I thought we might use the nitrous oxid and oxygen anesthesia. I operated upon about thirty cases under this anesthesia. They were practically all resections of the rib. All of those cases went through the operation without shock or disturbance of their general condition and all suffered no discomfort or pain whatever, making a good recovery.

In my experience with those cases, I should want to give something beside the local anesthesia if it could be given safely. I believe that it is perfectly safe if used by a person accustomed to giving it, and the patient is very much more comfortable during and after the operation and suffers less from shock than under local anesthesia. It makes a great deal of difference how it is

given. Anesthesia must be given with brains. I believe that with the proper use of these anesthetics, especially nitrous oxid and oxygen, the greatest benefit will come to the patients on whom they are used.

DR. JAMES T. GWATHMEY, New York City.—The principle of the thing is in determining who should be operated upon at once in order to prevent infection as well as for other reasons. We have used ether and sometimes chloroform and we now use nitrous oxid and oxygen, usually having three tables with two big tanks forming the extra table. The surgeon operating does not change his uniform, only sterilizes his hands, puts on sterile clothes, and has a sterile towel from a sterile nurse, and as we had two nurses we kept the bearers busy. We operated on twenty-seven patients, taking them just as they came. Some men sometimes found a foreign body, and after making an excision sent the patient away. The instant the surgeon was through, the next patient, who was prepared ahead of time, was already sterilized and waiting for him. This was done by using the same big tanks and simply changing masks, thereby determining the efficiency of any operating team by utilizing the full time of the surgeon. The surgeon never had to wait. There were on one day twenty-seven cases waiting for the surgeon between the hours of two in the afternoon and eight at night. The surgeon was sterilized from three to five minutes and by that time the patient would be ready, so you can see that no time was lost whatever. But, of course, he did not care to do that every day. In regard to the advantages of nitrous oxid and oxygen, we save the patient at the start from a deep anesthesia. It does not make any difference what kind. The method of light anesthesia was frequently used from start to finish, and this enables the surgeon to do what he wants to do, and the patient comes out of the anesthesia as soon as the mask is removed.

Dr. Truesdale spoke of his discovery of how morphia was considered dangerous by the French surgeons. I was with the French army and recognized that same effect. You should remember that with the French surgeon if your mother was dying you would not give her morphia. They think it akin to sin to give a patient morphia. Dr. Truesdale's statement in regard to a mortality of fifty per cent. was mild. We were not able to follow up the mortality of our cases that far. These statistics will probably be published within the next twenty or thirty years. The mortality was something distressing, and it was terrible to see the men brought in dying in spite of every method and in spite of every kind of surgery taking place.

Dr. Miller's question in regard to the position of the patient is important. If the position of the patient was moved on the table in the first half hour after the anesthesia, it did not make much difference, but if altered after that it makes a great difference and causes a lowering of the blood pressure. If other work was to be done, we usually did that work first and then turned the patient over and did the chest work, but whenever a patient was moved after the first half hour of anesthesia it immediately caused lowering of the blood pressure. Sometimes the surgeon gets down under and keeps the patient in the same position. In regard to gradual removal of positive pressure, let it go down very slowly. Keep the positive pressure until the sutures are finally made and closed up and for some little time afterward, and then very gradually let down the pressure to about normal, taking as long as the case allows; if possible take five minutes.

Dr. Keefe referred to vomiting necessitating removing the mask. Sometimes the stomach would be full, but that did not occur very often. In such instances take the mask off, take a towel, wipe off the mouth and put back immediately.

Dr. Cutts referred to the local anesthesia and the trouble he had noticed with it. I have seen the same thing. I am glad to hear him bring out something that seemed to be in favor tonight. Pain is a great factor in shock. Now in using local anesthesia we have one method now used in thousands of cases in place of ether by mouth. By using the local anesthesia you will find that the pain is practically eliminated from your operation if used after ether.



## Book Reviews

**Anesthesia in Dental Surgery.** By THOMAS D. LUKE, M.D., F.R.C.S. ED. and J. STEWART ROSS, M.D., F.R.C.S. ED. *Fourth Edition.* Twenty-two illustrations and 240 pages. C. V. MOSBY Co., St Louis, Publishers, 1920

It is interesting to note that some 15 years ago when the idea of the present volume, the first of its kind, was conceived, it was refused by more than one publisher on the ground that there was *no field*. The fact that Luke and Ross' Manual has gone into its *fourth edition* and that several kindred volumes have since appeared again goes to prove that even publishers may make mistakes. The bulk of the preparation of the *fourth edition* has fallen on the senior author but Ross returned from the Western front in time to incorporate under Sequences some of the experience in nitrous oxid-oxygen anesthesia gained and extended in war hospital work.

The main structure of the volume remains largely as before but a chapter on ether and chloroform have been added to do away with the necessity of reference to other manuals and it is hoped that the value of the work has thereby been enhanced.

After a concise resume of the History of Anesthesia the co-authors devote considerable space to the Choice of the Anesthetic in dental surgery with a rather exhaustive review of how nitrous oxid, ethyl chlorid, ether and chloroform may best be given to meet the needs of the anesthetist and dental surgeon. The objections to chloroform are very frankly stated. In discussing Sequences and Combinations the co-authors elaborate on certain methods that have come to be recognized standards of administration. The chapter on Local Anesthesia is drawn mostly from the Monograph on the subject by Dr. Sauvez of L'Ecole Dentaire, Paris. The Accidents of Anesthesia are rather fully dwelt upon and ways and means are suggested for combating them. Owing to the difference in dental education and licensure in England and Scotland the co-authors close their work with a special chapter devoted to the much debated question—How far is the L. D. S. diplomate entitled to administer the various anesthetics? Throughout the entire volume great stress is laid on the value of ethyl chlorid, especially in combination with other anesthetics.

## Society Proceedings

*Membership in a society devoted to your specialty is an essential to success.*

### INTERSTATE ASSOCIATION OF ANESTHETISTS —SIXTH ANNUAL MEETING.

The Interstate Association of Anesthetists held its Sixth Annual Meeting in the William Penn Hotel, Pittsburgh, Pa., October 5-7, 1920, in conjunction with the National Anesthesia Research Society.

During the Executive Session the Minutes and Treasurer's Report of the 1919 meeting were accepted as read. The following officers were elected for the 1921 meeting: Samuel Johnston, M.D., Toronto, Chairman; Arthur E. Guedel, M.D., Indianapolis, Vice-Chairman; F. H. McMechan, M.D., Avon Lake, O., Secretary-Treasurer; Members of Executive Committee, R. S. Adams, M.D., San Antonio; Wesley Bourne, M.D., Montreal; C. N. Chipman, M.D., Washington; L. Biddle Duffield, D.D.S., Philadelphia; H. R. Francis, D.D.S., Toledo, and Frances E. Haines, M.D., Chicago.

In opening the Scientific Sessions, Dr. J. J. Buettner, of Syracuse, in retiring presented the gavel to Dr. W. I. Jones, of Columbus, as Chairman. The Address of Welcome in behalf of the medical profession of Pennsylvania was given by Dr. Donald Guthrie, of Sayre, Pa., after which Mr. Stephen Morris, of Philadelphia delivered his

Presidential Address in behalf of the National Anesthesia Research Society.

During the Joint Scientific Sessions of the Interstate and N. A. R. S., the following papers were presented: The Hemoglobin Index as an Indication of Oxygen Need During Anesthesia, (Chairman's Address), W. I. Jones, D. D.S., and Clayton McPeck, M.D., Columbus, O.; Further Studies in the Effects of Anesthetics on Animals Infected with Tuberculosis Through the Respiratory Tract, J. B. Rogers, M.D., Cincinnati; The Rate of Evaporation of Ethyl Chlorid from Oils, Charles Baskerville, Ph.D., New York City; Primary and Secondary Nitrous Oxid Saturation for Relaxation and as a Test of the Patient's Capacity for Operation, E. I. McKesson, M.D., Toledo; The Value of Blood Chemistry to the Anesthetist, John J. Buettner, M.D., Syracuse; Air Control and the Reduction of the Postoperative Death Rate, Ellsworth Huntington, Ph.D., New Haven; An Explanation for the Antagonistic Action of Substances Such as Caffein to the Action of Narcotics, W. E. Burge, M.D., Urbana; Draw-Over Ether Anesthesia and Its Results from a Study of Cases, A. S. McCormick, M.D., Akron; The Drop Method of Ether-Vapor Anesthesia and Apparatus for its Administration, S. Griffiths Davis, M.D., Baltimore; The Oral Administration of Nitrous Oxid-Oxygen Anesthesia for Prolonged Neurological Operations, George W. Tong, M.D., Brooklyn; Experiences with Anesthesia in Major Intrathoracic Surgery: A Consideration of the Intraparyngeal vs. the Intratracheal Method, Wm. Branover, M.D., New York City; Anesthesia for Operations on Children, Edward W. Beach, M.D., Philadelphia; The Psychology of Music in Relation to Anesthesia, Esther Gatewood, Ph.D., Pittsburgh; and The Specialty of Anesthesia in Relation to the Medical Schools and Teaching Hospitals, Isabella C. Herb, M.D., Chicago.

During the Joint Session of the Interstate and N. A. R. S. with the Odontological Society of Western Pennsylvania the following papers were presented: Nitrous Oxid-Oxygen—Anesthol for Extraction Operations, M. Ecker, D.D.S., New York City; Standardization of Nitrous Oxid-Oxygen Anesthesia Induction, J. A. Heidbrink, D.D.S., Minneapolis; Selective Anesthesia for Oral Surgery, Charles Burmeister, D.D.S., Cincinnati, and on request from many of those present Dr. McKesson repeated his paper, previously delivered.

During the Joint Session of the Interstate and N. A. R. S. with the Medical Society of the State of Pennsylvania the following papers were presented: Blood Pressure Guides During Anesthesia, and Operation, A. H. Miller, M.D., Providence; Further Studies in Carbon Dioxid Inhalation After Anesthesia, Stanley P. Reimann, M.D., Philadelphia; Third Stage Ether Anesthesia: A Sub-Classification, Arthur E. Guedel, M.D., Indianapolis; The Anesthesia Problem in Lung Surgery, James T. Gwathmey, M.D., New York City; Nitrous Oxid-Oxygen Anesthesia and Analgesia in Normal Labor and Operative Obstetrics, W. C. Danforth, M.D., Evanston, and Nitrous Oxid-Oxygen Anesthesia for Sinus and Tonsil Surgery in the Forward Inclined Sitting Posture, Ira O. Denman, M.D., Toledo.

Through the courtesy of Drs. J. R. McCurdy, J. Wade Elphinstone, and C. M. Thomas anesthesia clinics were held at the St. Francis, Allegheny General and South Side Hospitals on Wednesday and Thursday mornings and a number of the visiting anesthetists were able to demonstrate the newer methods of anesthesia.

The N. A. R. S. Committee awarded \$50 prizes to Drs. S. P. Reimann and E. I. McKesson and \$25 prizes to Drs. Arthur E. Guedel, James T. Gwathmey, J. B. Rodgers and Ellsworth Huntington for the best research papers presented during the meeting.

The Annual Dinner was served at the William Penn Hotel and was a very enjoyable affair and was enlivened with music, singing and after-dinner speaking. The presidents of five anesthesia societies were present. As usual the visiting ladies were delightfully entertained at theater parties and sight-seeing trips and country club teas.

The following candidates of the medical and dental professions were elected to membership: Drs. E. E. Allgeyer, New Orleans; G. A. Allison, Cleveland; Frank O. Barrett,



El Paso; Philip B. Benz, Pittsburgh; Philip E. Brundage, Cresskill, N. J.; Archer C. Bush, Verona, N. J.; Ansell M. Caine, New Orleans; F. M. Caldwell, Pittsburgh; C. E. Carroll, Pittsburgh; Geo. W. Cooperrider, Columbus, O.; Harry Depan, Glens Falls, N. Y.; R. M. Erwin, Pittsburgh; G. H. Gehrmann, Parlin, N. J.; G. M. Geldert, Ottawa, Canada; H. D. Graham, Brownsville, Pa.; Bessie Greenberger, Pittsburgh; Dewitt Hall, Pittsburgh; R. B. Hammond, White Plains, N. Y.; S. S. Haudenschild, Carnegie, Pa.; J. A. Hiedbrink, Minneapolis; John T. Henderson, Cleveland; David E. Hoag, Pueblo, Col.; Harry E. Hunt, Newark, O.; Bertha van Hoosen, Chicago; W. J. Hunnicutt, Asheville, N. C.; John M. Jamison, Pittsburgh; Gaior Jennings, West Milton, O.; Gordon L. Jepson, London, Canada; Maurice V. Kahler, Indianapolis; F. L. Long, Zanesville, O.; M. M. Lower, Canton, O.; Herbert B. Mason, Calais, Maine; J. L. McBride, Pittsburgh; Lester D. Norris, Fairmount, W. Va.; Samuel E. Sawyer, Lewiston, Maine; W. T. Shannon, Detroit; Geo. W. Tainter, Jr., St. Charles, Mo.; Wm. F. Temple, Jr., Boston; C. M. Thomas, Pittsburgh; Elizabeth S. Tibbets, Cumberland, Md.; Ivy S. Titzell, Salina, Kan.; Wm. F. Tremaine, Rome, N. Y.; Geo. W. Tong, Brooklyn; Everett A. Tyler, Philadelphia; Henry Clay Veatch, San Francisco; Don A. Warren, Hamilton, Canada; Charles J. Wells, Syracuse, N. Y.; Marion L. White, Dixon, Ills.

During the final Executive Session the uniform Resolutions against the lay anesthetist and in favor of a Section in the A. M. A. were unanimously passed. The Secretary was voted an appropriation of \$300 and expenses for services during the past year. The next place of meeting and date were left to the decision of the Executive Committee.

## Quarterly Index

ANESTHESIA AND ANALGESIA IN THE MANAGEMENT OF DYSTOCIA. C. H. Davis, Milwaukee. Wisconsin Medical Journal, October, 1920.

ANESTHESIA, GENERAL, VS. LOCAL FOR FAUCIAL TONSIL REMOVAL. Frank D. Boyd, Fort Worth, Texas. Southern Medical Journal, October, 1920.

ANESTHESIA IN TONSIL AND ADENOID OPERATIONS. C. Yorke. British Medical Journal, August 28, 1920.

ANESTHESIA, GENERAL, PRESENT STATUS OF. A. Rodriguez Agana. Semana Medica, Buenos Aires, April 29, 1920. Vol. 27, No. 18.

APPARATUS—A SELF-FILLING SYRINGE FOR LOCAL ANESTHESIA. W. W. Babcock, Philadelphia. Surgery, Gynecology and Obstetrics, August, 1920.

APPARATUS—NEW FORM OF ETHERIZING DEVICE FOR USE IN ANIMAL EXPERIMENTATION. G. Raap and D. E. Jackson, Cincinnati. Journal of Laboratory and Clinical Medicine, August, 1920.

ANESTHESIOLOGY AND THE ANESTHETIST, THE PRESENT STATUS OF. Eleanor Seymour, Los Angeles. California State Journal of Medicine, October, 1920.

BENZYL ALCOHOL FOR TOOTHACHE. D. I. Macht, Baltimore. Journal American Medical Association, October 30, 1920.

CARDIAC UPSET, ACUTE, OCCURRING DURING OR FOLLOWING SURGICAL OPERATIONS: THEIR MECHANISM AND MANAGEMENT. Samuel A. Levine, Boston. Journal American Medical Association, September 18, 1920.

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## THE FACTORS THAT INFLUENCE THE PROGNOSIS IN FRACTURES AT THE BASE OF THE RADIUS.\*

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Fractures at the lower end of the radius have attracted the attention of many writers, and Pilcher's<sup>1</sup> article on this injury is a classical exposition of the subject. Like Pilcher's contribution, most of the descriptions of the injury do not deal at any length with the factors which have to do with the prognosis, with this exception, that practically all the writers believe that a proper reduction is one of the factors essential to a satisfactory outcome.

For a number of years this problem has been attracting the attention of one of us (J. M. H.) and, in collaboration, we have endeavored to determine what factors influence the result. Before beginning our own investigation we obtained from the literature such opinions as related to this subject.

Stimson<sup>2</sup> mentions that some deformity, as a rule, results in adults, and that function may be somewhat restricted, especially movements in supination because of the infiltration of the pronator quadratus. He states that rigidity of the wrist and fingers may persist in the aged and rheumatic, and in those cases in which there has been much inflammation in the tendon sheaths and in the wrist joint.

Scudder states that the line of fracture may involve the lower radio-ulnar joint and he explains the delay in the return of movements in supination by this factor. He furthermore states that some widening of the wrist will remain after most Colles' fractures, and at the end of his paragraph states that the more nearly the deformity is corrected at the first setting, the milder will be the pain about the wrist.

Cotton believes that bad results "in so far as function goes" are the result of bad treatment rather than the injury. Further on he mentions weakness on the ulnar side of the wrist and limitation of flexion, limited adduction, etc., none of which does he consider as factors productive of any special trouble.

Dwight states that it was invariably the mildest

cases, i. e., those without injuries to the soft parts and joints, that showed the quickest functional recovery, and that cases with considerable joint reaction required longer immobilization, but that their slower functional recovery was due not to the immobilization but to the conditions in the joints. He furthermore points out that a poor functional result may be laid to a severe injury. The use of anesthesia for the reduction gave a better anatomical result than when it was not used in his series.

Pilcher<sup>1</sup> states that in those cases of fracture at the base of the radius with appreciable displacement, some permanent deformity is unavoidable, i. e., the bone deformity is a result of the accident itself. Prominence of the head of the ulna with widening of the wrist and the loss of the anterior projecting tip of the radius and the more or less backward inclination upon the plane of the carpal articular surface of the radius are the most common permanent deformities resulting from the fractures at the base of the radius. The chief sources of functional disability are the consequences of the peri-articular changes such as matting of the tendons, contracture of the ligaments, and the formation of fibrous bands and adhesions. Too prolonged immobilization and undue pressure of splints may aggravate the functional disability.

Darrach and Dwight<sup>3</sup> believe that the pain over the head of the ulna and the limitation of pronation and supination, and adduction which may follow Colles' fractures are due to derangements of the inferior radio-ulnar joint, particularly in those cases in which the level of the articular surfaces of the radius is changed by impaction. They believe that the above pain and disability may be largely corrected by proper reduction.

Estes<sup>4</sup> in the report of the commission on fractures appointed by the American Surgical Association calls attention to the importance of the anatomical result in fractures near a joint, the importance of immediate reduction, the use of anesthesia, and the relation of the age of the patient to the excellence of the functional result.

T. W. Huntington<sup>5</sup> states that the following factors should be considered in the prognosis of fractures: (1) the personal equation of the patient, such as age, personality, etc. (2) the bone lesion, i. e., the fracture line, its character, coexisting comminution, its rela-

\*Read before the New York Physicians' Association in April, 1917, with lantern slide illustrations, but preparation for publication delayed by the war.



tion to a joint, and whether the lesion is single or multiple. (3) the injury to the soft parts. (4) the method of treatment used.

Troell<sup>6</sup> reports 117 cases which he followed from one to twelve months after the treatment was completed. Seven cases had no displacement, with a perfect anatomical result. The functional result was normal in four cases. There was some disability in one case. Two cases had rheumatism (pain?) and weakness of the hand.

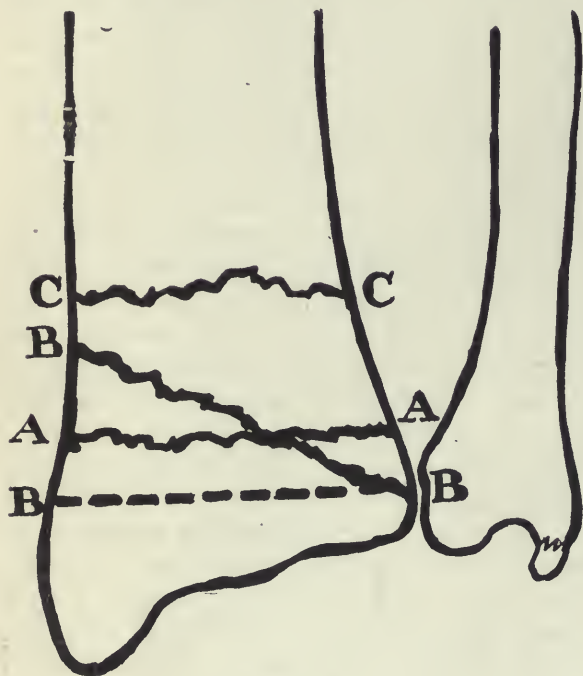


Figure 1.

In the cases with displacement:

*Anatomical result:*

No deformity .....	41
Good .....	9
Some deformity .....	11

*Functional result:*

Complete .....	30
More or less disturbance of function...	40

Further in his paper he quotes a percentage estimation of his findings for the 117 cases as follows:

*Anatomical result:*

Satisfactory in .....	80%
Definite deformity .....	20%

*Functional result:*

Satisfactory .....	76%
Unsatisfactory .....	24%

Krantz<sup>7</sup> in an analysis of 300 cases treated by the Lexer method gives the following:

Full ability to work .....	92.7%
Some disability .....	2.7%
Great disability .....	1.8%

Some loss of supination ..... 8.1%  
The only deformity mentioned is radial deflection of the hand which was present in 13.6% cases.

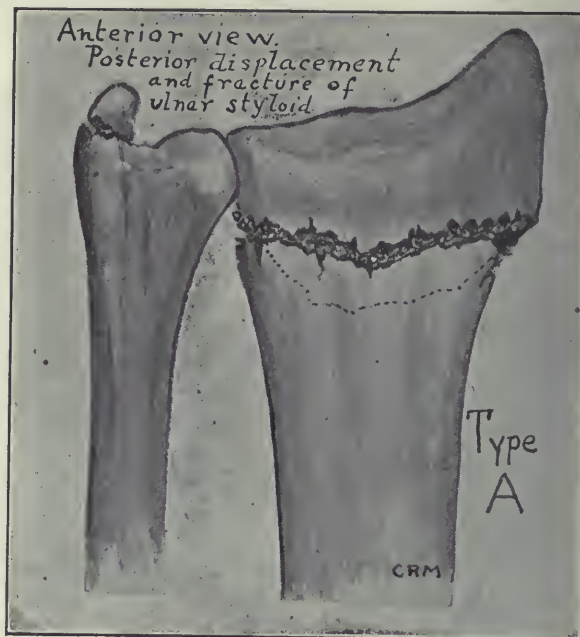


Figure 2.

Lexer<sup>8</sup> gives statistics for 110 cases treated by his method:

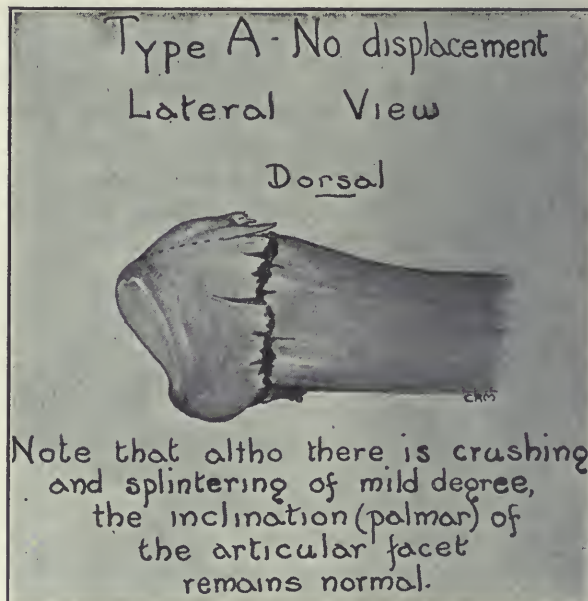


Figure 3.

*Anatomical result:*

Slight radial displacement .....	13.6%
----------------------------------	-------

*Functional result:*

Limitation of more than 5% in supination .....	18.1%
--	-------



Limitation of flexion and extension. 21.3%  
 Could not close the hand completely  
 (make a fist) ..... 7.3%

### Type A Posterior Displacement

#### Lateral View

Note splintering of posterior surface, and change in direction of articular facet

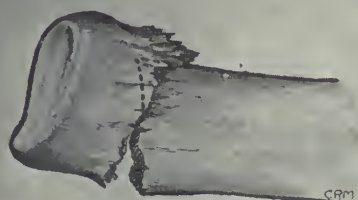


Figure 4.

### FRACTURE INTO ARTICULAR SURFACE

#### CENTRAL TYPE

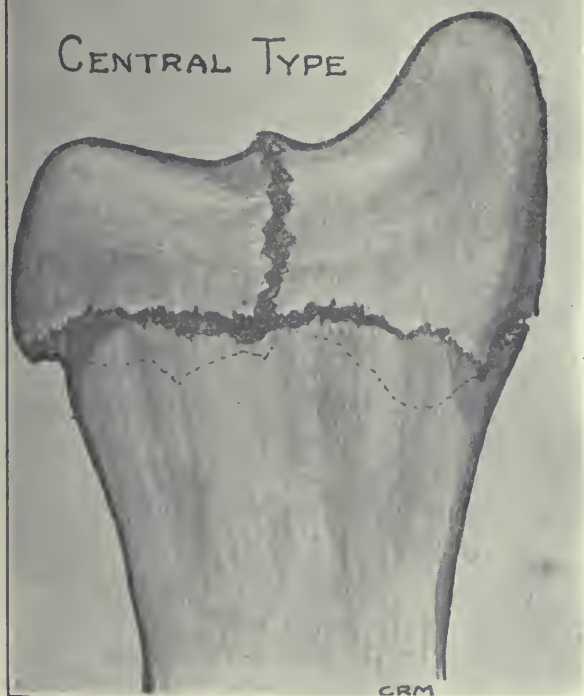


Figure 5.

The above, while by no means an exhaustive review of the literature, demonstrates quite clearly the ab-

sence of any standard conception for reporting the result of fractures at the base of the radius but from this mass of literature one can glean the fact that some anatomical deformity, some functional and industrial disability, are a very common result of fractures in the region under discussion.

In general, then, the factors that influence the prognosis in fractures at the base of the radius may be said to be:

1. The character and location of the line of fracture and the degree and variety of the displacement.
2. The reduction of the fracture, whether perfect,

### FRACTURE INTO ARTICULAR SURFACE

#### Peak Type

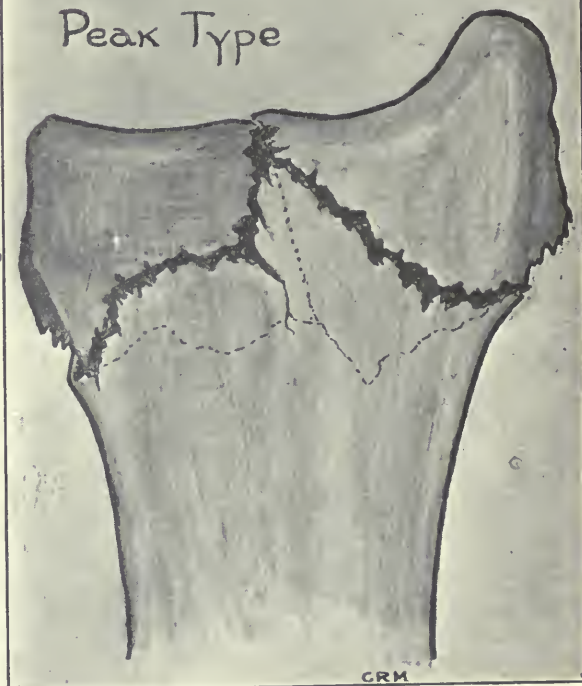


Figure 6.

complete, or imperfect or incomplete. The time of reduction. The use of anesthesia for reduction.

3. The treatment,—mobilization and immobilization, (type and length of), massage and baking.

4. The age of the patient.

5. The temperament of the patient.

The only element in the above five factors that influence the prognosis which seemed to us to be constant was the first-named. By that I (J. M. H.) mean that if we could determine the approximate number of times that any given line of fracture and displacement appeared in a series of routine cases, it would be possible to express at least an approximate



prognosis for similar types as determined by clinical analysis.

In this paper it is our purpose to submit the result of an analysis of: 1. A series of consecutive *x*-ray plates of fractures at the base of the radius taken from the files of the *x*-ray department of the New York Hospital; 2. An analysis of 130 clinical cases observed for more than one year for their cosmetic, functional and industrial result.

While the clinical cases bear no definite relationship

in rotation it soon became evident that the line of fracture was a constant factor for certain definite

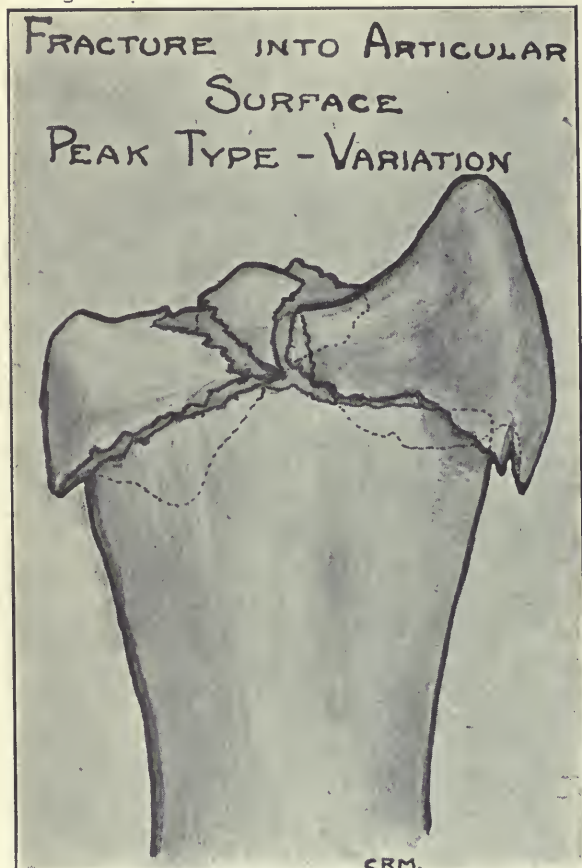


Figure 7.

to the *x*-ray series except in isolated instances, the *x*-ray plate of each clinical case was, after examination, placed under its appropriate type as classified in the type chart. Using the type chart as a basis, charts will be presented showing the result for each given type as determined by this analysis of a given series of clinical cases.

The *x*-ray plates of 213 consecutive cases taken from the *x*-ray department of the New York Hospital (January to December 31st 1916) were examined to determine the possibility of making a working classification of the routine types of fractures at the base of the radius.

When the plates of these fractures were inspected

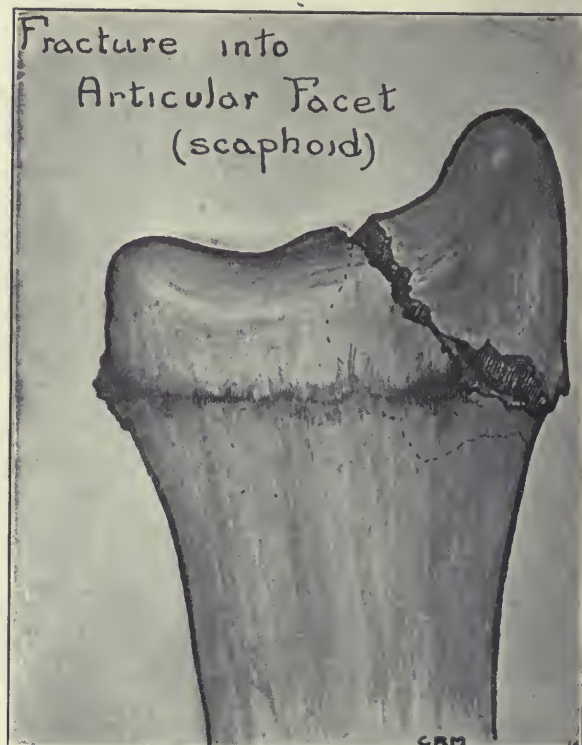


Figure 8.

types, i. e., a grouping of the plates into types was possible, from the similarity of the line of fracture. (Figure 1).

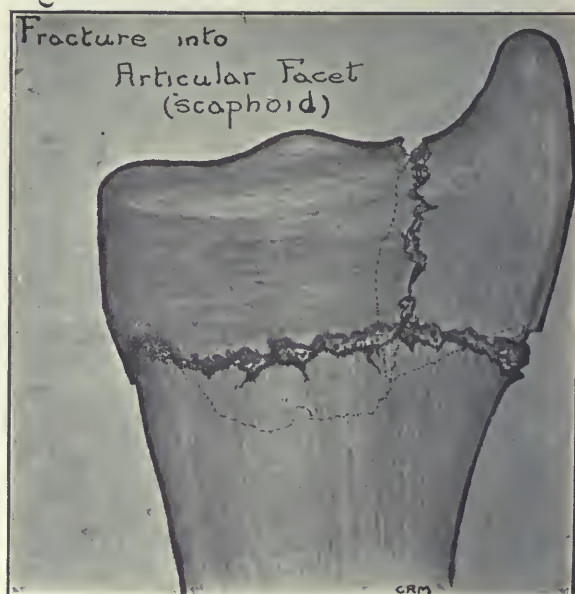


Figure 9.

For purposes of classification we have divided the recurring types into seven groups, namely: Types



A, B, C, Radial Styloid, Epiphyseal Separation, Longitudinal Split, Both Bones (1. at the level of Type A with posterior displacement of the carpal

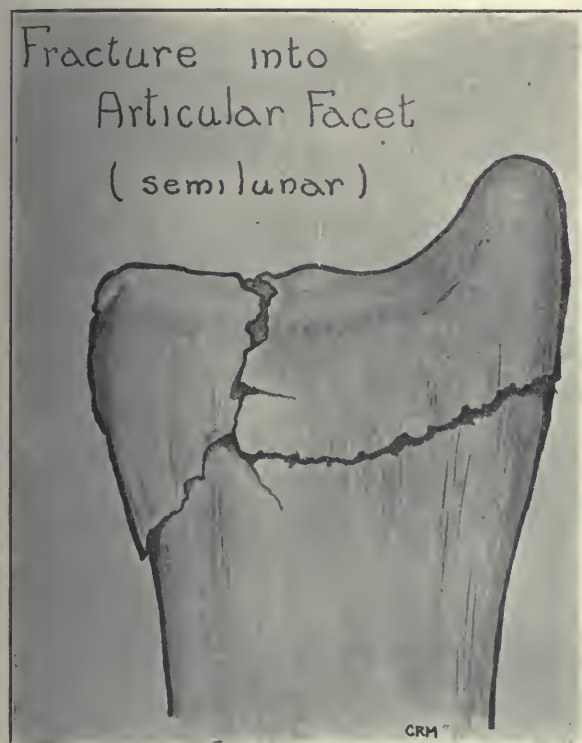


Figure 10.

fragments; 2. with anterior displacement of the carpal fragments, the so-called "reverse Colles").

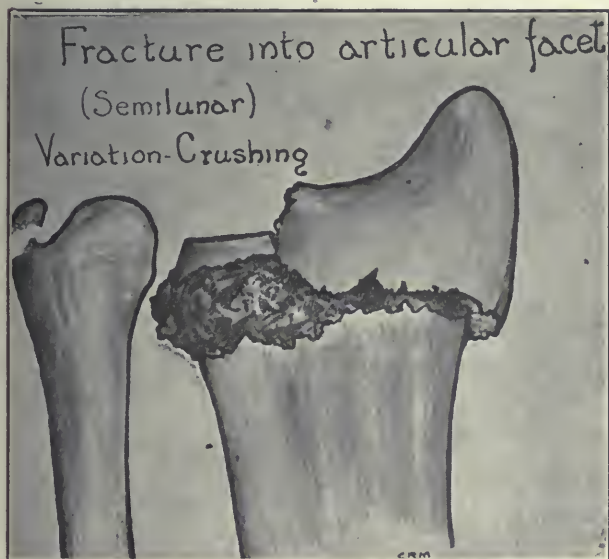


Figure 11.

(Undoubtedly there may be minor modifications and variations which will have to be added to this classification.)

Type A: (see Chart 1.)

Type A is characterized by a transverse line of fracture which begins 1.5 to 2 cm. above the tip of the radial styloid on the radial side of the bone, and ends just above, to 0.5 cm. above the inferior radio-ulnar joint on the ulnar side of the bone. (Figure 1)

This is the most common form in which fracture of the base of the radius occurs. There are 169 cases, 79 + %, in the series. Among these 169 cases the ulnar styloid was broken in 129 cases and in 40 cases it remained unbroken.

This type shows certain definitely recurring variations in the line of fracture, and in the degree and direction of the displacement of the fragments.

(1.) The most common form is that with posterior displacement of the lower fragment with the associated angular deformity at the line of fracture

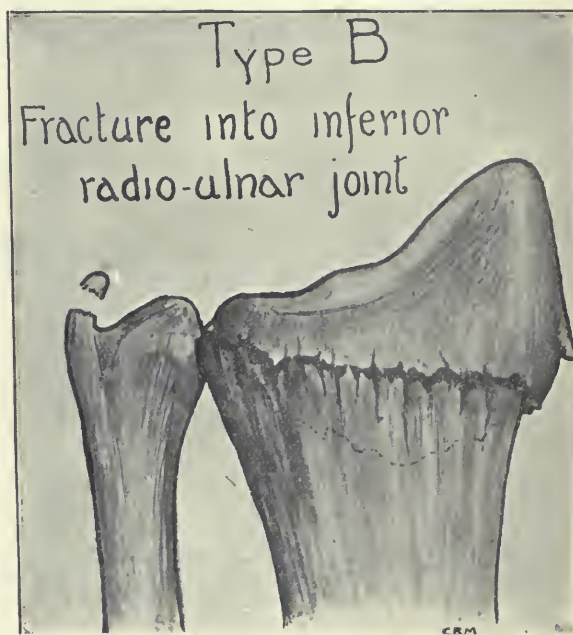


Figure 12.

and the accompanying change in the inclination of the radio-carpal articular facet of the radius. In this type there is commonly a moderate degree of splintering of the posterior surface of the lower fragment. In our series, 102 cases were of this type. In 76 the styloid process of the ulna was broken. In 26 cases the ulnar styloid was not broken. (Figures 2, 3, 4.)

2. The second variation most commonly found consists in a line of fracture which runs from the A-line through the articular surface of the radius, i. e., a line of fracture into the wrist-joint. This variation appears in five groups:

(a) A central line which passes at right angles from the A-line through the ridge between the articular facets for the scaphoid and semilunar, thus



forming two quadrilateral fragments. (Figure 5.)

(b) An irregular line of fracture which passes obliquely from the A-line into this dividing ridge and forms two roughly triangular fragments. To this one of us (Murray) has given the descriptive title of the "Peak Type." As a variation of this type the splintering off of this dividing ridge as a separate fragment may occur. (Figures 6 and 7.)

(c) A fracture line through the articular facet for the scaphoid which splits off a triangular fragment on the radial side. (Figures 8 and 9.)

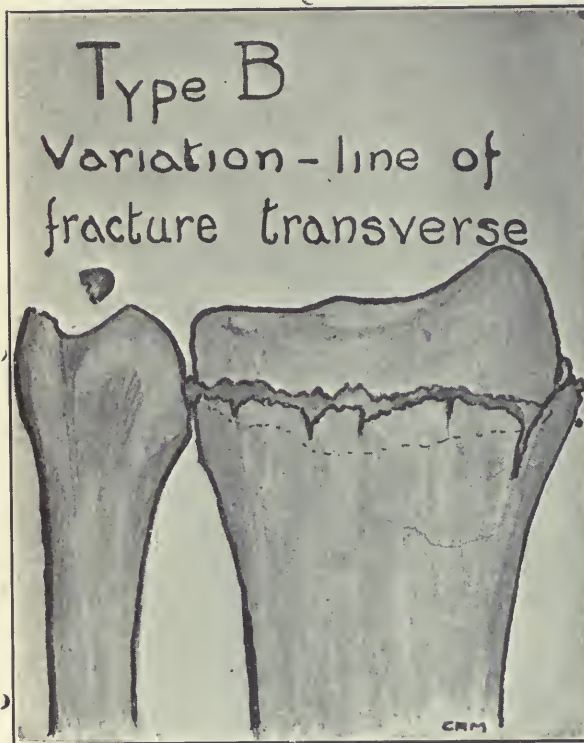


Figure 13.

(d) A fracture line through the articular facet for the semilunar which splits off a triangular fragment on the ulnar side of the base of the radius. (Figures 10 and 11.)

(e) In this group were placed two cases with severe crushing of the lower fragment which split it into numerous fragments with many lines of fracture involving the wrist joint.

The total number of cases of this variation in our series was 21, divided as follows:

(a) Central line	3	Styloid broken	3
(b) Peak type	5	Styloid broken	5
(c) Variation	2	Styloid broken	2
(d) Scaphoid line	5	Styloid broken	5
(e) Semilunar	4	Styloid broken	3 (Unbroken, 1)
(f) Complicated crushing	2	Styloid broken	2
Total	21		20

3. The third most common variation was radial displacement of the lower fragment in addition to the common posterior one. This is characterized by the greater prominence of the head of the ulna, by marked radial deflection of the carpus, and by greater involvement of the radio-ulnar articulation.

In our series there were 15 cases of this variation, ulnar styloid broken in 9, unbroken in 6.

4. A fourth variation is due to the crushing of



Figure 14.

the lower fragment with varying degrees of splintering of that fragment and the penetration of the upper fragment into the lower. There is the usual posterior displacement, the angular deformity, and likewise some radial displacement of the lower fragment and the carpus. Due to this crushing and penetration, the radial styloid lies at a much higher level, the head of the ulna is much more prominent, and radial deflection of the carpus is constantly present.

In our series there were 12 cases of this variation, with 10 fractures of the ulnar styloid. In 2 cases the ulnar styloid was unbroken.

5. The fifth variation presents the common line, but no displacement is evident. The configuration of the bone and the inclination of the articular sur-

face are normal, and it is often difficult to demonstrate a line of fracture in the *x*-ray plate.

Of this variation there were 10 cases, with the ulnar styloid broken in 8, and unbroken in 2.

6. The sixth variation is a somewhat higher line of fracture through the radius, i. e., the line of fracture crosses the bones about 1.75 cm. to 2.5 cm. above the tip of the radial styloid. It shows the characteristic displacement with the altered inclination of the articular facet and some radial displacement. This type occurred in large-boned men, and the higher level may be explained by the size of the bone. Our series contained 9 cases of this variation, with fracture of the ulnar styloid in 6, and an unbroken styloid in 3 cases.

in adolescents before the fusion of the epiphysis with the diaphysis.

There was one adult case in this series, a woman.

The number of cases was 7, a percentage of 3.2 of this series:

Adolescents	6	Styloid broken	6
Adult,	<u>1</u>	Styloid unbroken	<u>1</u>
	7		6

Epiphyseal separations occurred in 10 cases, or 4.7%, in this series. The ulnar styloid was broken in 7 of these and unbroken in 3.

Fracture of the radial styloid occurred 7 times, or 3.2%, in this series. In 6 cases there was a coincident fracture of the ulnar styloid.

Fracture of both bones at the wrist occurred

CHART 1: TYPE CHART

Type	No. of Cases	Ulnar Styloid Broken	Ulnar Styloid Unbroken		No. of Cases	Ulnar Styloid Broken	Ulnar Styloid Unbroken
A-type .....	169	129	40	A-line pure .....	102	76	26
				Secondary line into wrist-joint .....	21	20	1
				Radial displacement ....	15	9	6
				A-line without displacement .....	10	8	2
				Crushing .....	12	10	2
				A-line high .....	9	6	3
				TOTAL .....	169	129	40
B-type .....				Oblique line .....	14	10	4
				Transverse line .....	3	0	3
				TOTAL .....	17	10	7
C-type .....	7	6	1				
Epiphyseal separations ..	10	7	3				
Radial styloid .....	7	6	1				
Both bones .....	2	0	2				
Longitudinal split .....	1	0	1				
TOTAL .....	213	162 (76%)	51 (23.9%)				

Type B: (see Chart 1 and figure 1.) Figures 12 and 13.

Type B is characterized by a line of fracture which involves the inferior radio-ulnar joint. This line may begin at 2 to 2.5 cm. above the styloid on the radial side and pass obliquely into the joint, or it may be a transverse line crossing the bone at the level of the middle of the inferior radio-ulnar joint.

Our series contained 17 cases of this type (7.9%), divided into:

Oblique form, 14—with fracture of ulnar styloid 10; without 4
Transverse " <u>3</u> — " " " " <u>3</u> ; <u>0</u>
17 13 4

Type C: (see Chart 1, figure 1 and figure 14.)

Type C is characterized by a higher line of fracture than either of the above, 3 to 3.75 cm. above the radial styloid, usually oblique and occurring chiefly

twice. The radial fracture line crossed at the level of the A-line above described and the line of fracture in the ulna crossed that bone just above the ulnar head.

There were two cases, 0.9 + %, in this series. In one of these cases the lower fragments were displaced anteriorly.

One case, or 0.45%, in this series was a longitudinal split which began in the scaphoid facet of the radius and ran longitudinally up the shaft of the bone.

From the above *x*-ray analysis of the routine fractures Chart I has been prepared as a basis for computing the deformity, etc., as based upon the lines of fracture thus determined.

As has been stated, the above analysis of the *x*-ray plates was made to establish a "type chart," based upon the location of the line of fracture, the character and extent of that line of fracture, and such other factors, as the degree and character of displacement, as could be determined by the *x*-ray plate.

From the above analysis of a routine series of



*x*-ray plates of fractures at the base of the radius it can be safely stated:

1. That there is a definite variation in the location of the line of fracture.
2. That this variation is sufficiently constant to classify the fracture into typical groups (viz. A, B, C, etc.).
3. That the common fracture is that described here under the "A" type.

charts an attempt is made to show the effect of the age of the patient, the effect of the time of the reduction and the effect of the character of that reduction (whether complete or incomplete) upon the result obtained.

With slight exception this entire clinical series was submitted to exactly the same line of treatment, viz., reduction under nitrous oxide-oxygen anesthesia (ether in 10 cases; no anesthesia in 9 cases of type

CHART 2: DEFORMITY CHART  
Early Reductions (Complete)

Time of Reduction	Type of Fracture	No of Cases	None	Degree of Slight	Deformity Moderate	Marked
Early complete ..	Pure A over 50 years .....	5		4	I	
	Pure A under 50 years.....	20		20		
	A-line with line into wrist-joint .....	0				
	A-line with radial displacement .....	2		I	I	
	A-line with marked crushing .....	0				
	A-line without displacement .....	10	2	8		
	A-line high .....	3	2	I		
	B-type .....	4		I	3	
	C-type .....	6	3	3		
	Epiphyseal separation .....	5	I	4		
	Radial styloid .....	3	I	2		
	Both bones .....	I		I		
	TOTAL .....	59	9	45	5	

4. That fracture of the styloid process of the ulna is more frequent than is ordinarily stated.

Taking as a basis for clinical analysis the above "type chart," it at once became evident that one should find a wide variation in the anatomical, functional, and industrial result of injuries due to the variation in the type and character of the bone injury.

To determine such a relationship between the character and location of the line of fracture and the anatomical and functional result, the clinical records of 130 clinical cases were submitted to critical analysis.

As has been stated, these clinical cases have no definite relationship to the *x*-ray series except in isolated instances. The *x*-ray plate of each case used to complete the "Deformity" and "Function" charts, which appear with this paper, was examined and placed under its appropriate type, so that the clinical series will and does give a very definite idea of the end-result for the given "type" of fracture under discussion.

All of the cases reported for analysis have been followed for over a year, and the existing result for the cases submitted to this analysis.

In compiling the "Deformity" and "Function"

A without displacement); fixation by anterior and posterior moulded plaster splints, which allowed free movement of the fingers; movement of the fingers immediately after reduction insisted upon, massage begun as early as feasible and given during the first week either by the surgeon, or under his immediate supervision. Baking by dry heat begun within the first week after the injury.

The term "early" refers to cases reduced within six hours after injury, "late" refers to cases reduced 12 hours and upwards after the injury, "complete" refers to an exact anatomical replacement of the fragments (as determined by the *x*-ray); "incomplete" refers to a failure to completely replace the fragments along the line of fracture, or to a failure to correct the faulty inclination of the articular facet of the radius as determined by the *x*-ray.

To interpret these charts it is necessary to understand the normal range of motion of the region involved.

The normal range of motion at the wrist joint as ordinarily given is as follows:

Dorsal flexion .....	50°
Palmar " .....	55°
Radial " .....	55°
Ulnar " .....	30°

Pronation } each way from the middle  
supination } position ..... 90°

In the charts the functional condition is expressed in percentage terms, i. e., 100 in the supination column means complete supination or 90°, 50 in the supination column means 50% of 90°, or a limita-

There was a slight deformitory in 45 cases and a moderate deformity in five cases, i. e., there was a recognizable deformity in the vast majority of the cases.

The Functional Chart (Chart 3) shows the most marked disturbance for this group in the cases over

CHART (3): FUNCTION CHART.  
Early Reductions (Complete)

TYPE	No. of Cases.	Flexion	Extensior	Supination	Pronation	Radial Adduction	Ulnar Abduction	PAIN	REMARKS
A-type over 50 years ...	5	50	50	50	50	50	50	In all	Slow return of function, weakness in grip.
A-type under 50 years. .	10	100	100	100	100	100	100	None	Complete function.
	2	95+	100	100	100	100	100	After use in 1 case.	
	5	100	100	95+	100	95+	95+	In region of ulnar head in 3 cases. Weakness in grip in 1. Cramp in hand after writing in 1 case.	
	3	100	100	100	100	95	95	In region of ulnar head. Cramp in hand after writing in 1 case.	
A-type with line into wrist-joint .....	0	..	..	..	..	..	..		
A-type with radial displacement .....	2	100	100	99	100	99	100	None	
A-type without displacement .....	10	100	100	100	100	100	100	In 2 cases pain over ulnar styloid.	
A-line high .....	3	100	100	99	99	100	100		
B-type .....	4	100	100	80-90	90-95	95	95	Pain over inferior radio-ulnar joint after use in supination or pronation.	
C-type .....	6	100	100	99-100	100	100	100		
Epiphyseal separations...	5	100	100	100	100	100	100		
Radial styloid .....	3	100	100	100	100	100	100		
Both bones .....	1	90-95	90-95	90	95	90	95	Pain over inferior radio-ulnar joint.	
TOTAL .....	59								

tion of that motion to one-half normal, or 45° of supination, etc.

The degree of function was obtained by having the motion of the patient's wrist recorded on paper as a segment of a circle and the segment thus obtained compared to a segment of a circle made by the same patient's normal wrist, and the difference obtained by calculating the per cent. difference between injured and normal segments.

In 59 cases of early complete reductions (see Chart 2) there was no determinable deformity in 9 cases. Analyzing these cases we find that two were "A line" fractures, with angulation before reduction, three were the "C type" in adolescents, 1 an epiphyseal separation; and one a fracture of the radial styloid. All were mild injuries.

50 years of age, and also a greater delay in the return of function. The chart furthermore shows a greater functional disturbance in those types that produce the greater disturbance in the inferior radial ulnar joint (type B—and fracture of both bones).

From the above we may conclude:

1. That some deformity is the common result even in mild injuries.
2. That disability is a common result for this type in elderly individuals.
3. That disability is most marked in supination and pronation, especially in those types that involve the inferior radio-ulnar joint.

In the analysis of the clinical series in this paper 30 cases were incomplete reductions submitted to



the same early reduction as carried out in the previous 59 cases (v. s.)

The character of the reduction obtained was determined by the x-ray and was not revised because it was so slight as to seem negligible, or because it did not seem susceptible of correction, or because it did not seem wise to attempt further manipulative correction.

In 10 of the cases there was failure to restore the normal anterior and posterior inclination of the articular facet of the radius, and in these there was a more marked deformity with a remnant of the "silver fork" deformity, that is, a deformity greater than existed in the above 10 cases.

From the above, therefore, it can be stated that deformity, i. e., some widening of the wrist joint,

CHART 4: DEFORMITY CHART

Early Reductions (Incomplete)

Time of Reduction	Type of Fracture	No of Cases	None	Degree of Slight	Degree of Moderate	Marked
Early incomplete	Pure A .....	10		1	9	
	A-line with line into wrist-joint .....	10		1	5	4
	A-line with radial displacement .....	0				
	A-line with crushing .....	5			1	4
	A-line without displacement .....	0				
	A-line high .....	0				
	B-type .....	0				
	Epiphyseal separations .....	1				1
	Radial styloid (ulnar styloid not completely reduced) .....	4		2	2	
	Both bones .....	0				
TOTAL .....		30		4	17	9

Inspection of the Deformity Chart (Chart 4) shows that deformity was a constant factor, and that it was most marked in the severe injuries.

Further analysis of the 20 cases included in the first two groups in the chart shows that 10 were incomplete reductions at the line of fracture, i. e., the

greater prominence of the head of the ulna, some radial deflection of the hand and, in the cases of failure to correct the faulty inclination of the articular facet of the radius, some remnant of the "silver fork" deformity were constantly found.

Examination of the Function Chart (Chart 5) of

CHART 5: FUNCTION CHART

Early Reductions (Incomplete)

TYPE	No. of Cases	Flexion	Extension	Supination	Pronation	Radial Adduction	Ulnar Adduction	PAIN	REMARKS
Pure A .....	8 2	99 99	99 99	90-95 80-90	95-99 95	90-80 90	99-95		In inferior radio-ulnar joint after use.
A-line with line into wrist joint .....	5 5	70 40	70 60	60 40	95 60	80-90 50	80-90 80		Pain and stiffness in the morning in 1 case.
A-line with marked crushing .....	5	50	60	50	75	50	75	After use	Pain and insecurity in wrist especially in supination.
Epiphyseal separations	1	95	95	99	100	100	100		
Radial styloid .....	4	99	100	100	100	90	95	Pain in 3	
TOTAL .....	30								

articular facet of the radius was at the correct inclination, but there was a failure to completely overcome either the posterior or some other displacement, and in two of the cases the fractured ulnar styloid was not placed in complete contact with the line of fracture on the head of the ulna.

the early incomplete reductions, shows a constant disturbance of function most marked for the severe bone injuries, with constant presence of pain, except in the case of epiphyseal separation. The function most markedly interfered with was supination. Failure to correct the faulty inclination of the artic-

ular facet of the radius produced a greater disturbance in flexion than was present in correct position of that facet.

From the above one may then state:

I. That when the bone injury is such that it prevents the complete reduction of the fracture or when

to reduction after six hours, with an average delay between 12 and 24 hours.

In this series there are 41 cases, of which 13 may be classified as complete and 28 as incomplete reductions.

The 13 cases of complete reductions were cases

CHART 6: DEFORMITY CHART

Late Reductions (Complete)

Time of Reduction	Type of Fracture	No of Cases	None	Degree of Deformity Slight	Moderate	Marked
Late Complete .	Pure A over 50 years .....	5		1	2	2
	A-line with line into wrist-joint ....	0				
	A-line with radial displacement ....	3			1	2
	A-line without displacement .....	0				
	A-line with marked crushing .....	0				
	A-line high .....	0				
	B-type .....	0				
	C-type .....	1		1		
	Epiphyseal separations .....	3		1	1	1
	Radial styloid .....	0				
	Both bones .....	1			1	
TOTAL .....		13		3	5	5

the reduction is incomplete for other reasons, deformity is more marked and the disturbance of function is greater than in the early complete reductions; or, to state it in other terms, there is more deformity

of less severe injury, and less marked displacement than those recorded as incomplete.

Analyzing the charts (Nos. 6 and 7) one finds deformity present in all.

CHART 7: FUNCTION CHART

Late Reductions (Complete)

TYPE	No. of Cases.	Flexion	Extension	Supination	Pronation	Radial Adduction	Ulnar Abduction	PAIN	REMARKS
A-type pure over 50 years .....	3	50	50	20-30 50	50	50	50	In all	Very slow return of function. Weakness in grip. Stiffness in the morning.
	2	5	5	0	0	0	0	In all	Complete disability. Arthritis of the wrist. Atrophy of the hand, etc.
A-type with radial displacement ...	3	100	100	90	99	100	95	In all	Over radio-ulnar joint.
C-type .....	1	100	100	99	100	100	100		
Epiphyseal separations	3	100	100	95-100	100	100	100	None	Disturbance in growth in radius in 2 cases.
Both bones (reverse displacement) ..	1	95	99	95	100	100	100	None	Reduced by open operation.
TOTAL .....	13								

and disturbance in severe injuries and more deformity and disability in the milder injuries not completely corrected by the treatment.

The term late reduction applies to cases submitted

In the Function Chart one finds the most marked disability in the patients over 50 years of age, two of whom had practically a complete disability. Pain was a practically constant factor except in the four



last cases in the chart. In two of the epiphyseal separations there was a definite disturbance in the growth of the radius, which became evident at the six months interval, but did not increase beyond that observed at that time.

One may, therefore, conclude that late reductions

disturbance of function than occurs in the other groups, except for the two cases of complete disability in charts 6 and 7, and a greater and more varied degree of complaints.

Pain is a constant factor and is more marked in the severe injuries. Functional return is slower, and

CHART 8: DEFORMITY CHART

Late Reductions (Incomplete)

Time of Reduction	Type of Fracture	No of Cases	None	Degree of Slight	Deformity Moderate	Marked
Late incomplete	Pure A .....	10			2	8
	A-line with line into wrist-joint .....	10			5	5
	A-line with radial displacement .....	0				
	A-line with crushing .....	5				5
	A-line without displacement .....	0				
	A-line high .....	0				
	B-type .....	1				1
	C-type .....	1				1
	Epiphyseal separations .....	1				1
	Radial styloid .....	0				
	Both bones .....	0				
TOTAL .....		28			7	21

for a similar type of anatomical lesion will result in more deformity and in greater functional disturbance, and that all the above are more marked in the older individuals.

Analyzing the chart of the 28 cases of late incom-

in general is much less than for similar injuries reduced earlier.

One may conclude, therefore, that late incomplete reductions result in more deformity, greater disturbance in function, and a more varied degree of com-

CHART 9: FUNCTION CHART

Late Reductions (Incomplete)

Type	No. of Cases.	Flexion	Extension	Supination	Pronation	Radial Adduction	Ulnar Abduction	PAIN	REMARKS
A-type pure inclination of articulation.	2 8	80-60 70	100 *	95-90	99-99	100-90 99	100-99 100	Pain after use	Slow return of function.
A-type with line into wrist-joint .....	10	25	25	50-60	95-99	10	25	Pain after use	Stiffness and insecurity in movements putting strain at wrist.
A-line with marked crushing. ....	5	25-50	50-60	25-50	50	10-20	25-50	Pain in all	Many complaints as to disability.
B-type .....	1	80	90	50	90	99	99	Pain on supination	
C-type .....	1	100	100	95	90	100	100	?	Weakness in supination.
Epiphyseal separations	1	99	99	99	99	99	80	?	Lack of growth (?)
TOTAL .....	28	*More than normal							

plete reductions, one finds the cases of more severe bone injury with the more complicated forms of bone injury (Charts 8, 9.)

The deformity chart shows a large preponderance under the column "marked" deformity.

Analysis of the Function Chart shows a greater

plaints about the disability than occur in the other groups.

From all the above one may conclude (under exactly similar conditions of treatment):

1. That fractures at the base of the radius may be separated into definite groups, dependent upon

the location of the line of fracture as determined by the x-ray.

2. That deformity and disturbance of function are less marked in the mild injuries and more marked in the more severe injuries.

3. That the earlier the reductions for similar types the better the cosmetic and the functional result.

4. That the more complete the anatomical restoration, the less the deformity and the less the disturbance of function for similar types of bone injury.

5. That age has a definite effect upon the prognosis, and that similar bone injuries produce more disability over 50.

(The writers beg to acknowledge their indebtedness to Doctor Busby, the roentologist at the New York Hospital, for the courtesies extended them in his department.)

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#### PAINFUL AND DISABLED SHOULDERS.

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There are many affections and conditions, coming under observation of the physician and surgeon, which may produce disability in the shoulder, either transient or permanent; for the most part, however, the pains suffered in this region are of little clinical worth, for their existence is dependent upon a lesion more or less remote, and the inconvenience suffered is usually the expression of reflected pain.

In this category it is interesting to call attention to the disability and pain attendant upon a number of medical entities, that cause the patient discomfort in the scapular region. We therefore mention neuritis, cervo-brachial neuralgia, diaphragmatic pleurisy, dilated stomach, duodenitis; and, especially when occurring in the right shoulder, aortic disease, hepatic disease, gall-stone colic, aneurism of the innominate artery, etc.

This phenomenon, i. e., painful shoulder, may readily be explained in each particular instance, and in

illustration of this assertion we need but consider the pathological condition present in aneurism, wherein the spinal nerves become incorporated in the aneurismal sac, pain being referred to the back and to the left scapular region. In some hepatic diseases and in some instances of diseases of the gall-bladder and of the bile ducts, the occurrence of severe pain in the right shoulder finds a logical explanation in the transmission of irritation from branches of the phrenic nerve in the capsule of the liver and in the suspensory ligament to the fourth cervical nerve, which also receives branches from the shoulder.

Omitting consideration of the many varieties of fracture in the vicinity of the shoulder-joint, such as fracture of the clavicle, scapula, etc., we are confronted with a number of surgical conditions, any one of which is capable of causing marked shoulder disability, and each of which demands careful differentiation in arriving at a correct diagnosis. In this category we tabulate; sprain, subacromial bursitis, fracture of the tuberosity and of the anatomical and surgical neck of the humerus, inflammation of the sheath of the biceps tendon, paralysis of the circumflex nerve, chronic arthritis, tuberculosis of the head of the humerus, and acromioclavicular arthritis.

In the differentiation of these conditions, we must take cognizance of what, in too many instances, is regarded as a simple affection, but which a close and careful examination proves to be a condition demanding attention of the most painstaking kind. We refer to a sprain of the shoulder-joint.

Sprains of the shoulder are peculiar in character and are frequently most troublesome affections. The initial symptoms are often misleading. The patient admits a certain stiffness in the execution of familiar movements, and a forcing of the joint causes some pain. The articulation may remain stiff and painful, or it may be mobile, with the occurrence of severe pain upon attempted movement. Anatomically, differentiation from synovitis and bursitis becomes either a skilled surgical accomplishment or an almost impossible diagnostic feat, for detection of sprain of the shoulder offers almost insuperable difficulties in an effort to isolate it from pure synovitis, tenosynovitis, bursitis, periartthritis, and severe injury to the capsular ligament; any or all of these conditions it may readily embrace.

It behooves us, therefore, to take a rapid survey of the anatomical peculiarities of the shoulder-joint, especially a brief consideration of the subacromial bursa, for the occurrence of sprains and subacromial bursitis are accidents of considerable frequency.\*

\*James K. Young, Subacromial Bursitis, *The Therapeutic Gazette*, January 15, 1917.



The subacromial bursa is the largest bursa about the shoulder-joint. Its upper portion is intimately united to the top of the tuberosity of the humerus; its base is firmly attached to the underside of the acromion and the coracobrachial ligament. The loose periphery of the bursa is movable, and, rolling on itself, permits the roof to slide to the base. While the size of the bursa may vary, it may be regarded as about  $2\frac{1}{2}$  inches in diameter. The bursa seldom communicates with the joint. When diseased, abduction and upward pressure cause much pain, because the sac is pinched between the head of the humerus, and the lower surface of the acromion and the coraco-acromial ligament.

In considering subacromial bursitis, the main facts to be borne in mind are, besides the localized tenderness and swelling of the tip of the shoulder just below the acromion process, the limitation of both abduction and external rotation (*v. supra*); the scapula is locked by spasm, arm movement being accomplished by restricted rotation of the humeral head in the glenoid cavity, about  $10^\circ$  of an arc of a circle, being all that can be accomplished. There is pain over the point of the shoulder sometimes extending down into the hand, at other times referred to the point of insertion of the deltoid. At times, inflammation of the bursa may be detected by means of the *x*-rays; that ready demonstration can be made of the existence of calcareous deposits beneath the bursa, and at or beneath the attachment of the supraspinatus muscle, is a well-known surgical fact.

Fractures of the tuberosity and of the anatomical and surgical neck of the humerus are always responsible for painful and disabled shoulder-joints. They are accompanied by ecchymoses and swelling on the inner side of the arm. Fracture of the lesser tuberosity of the humerus, is occasioned by the same accident as produces injury to the subacromial bursa, *i. e.*, by falling on the fully extended hand. The diagnosis of fracture of the lesser tuberosity, reveals tenderness over the seat of fracture and later by ecchymosis extended down the tendon of the biceps to the elbow. Of course, diagnosis in such instances is readily demonstrable by the *x*-rays.

Inflammation of the sheath of the biceps tendon is manifested by pain along the course of the long head of the biceps, the abductors and the external rotator muscles of the arm. Pain at the beginning of abduction suggests inflammation of the sheath of this tendon, the pain in abducting the arm in instances of subacromial bursitis, as heretofore mentioned, being limited to about 10 degrees. Paralysis of the circum-

flex nerve is often incorrectly diagnosed as subacromial bursitis or even as fracture of the lesser tuberosity of the humerus. In circumflex paralysis there is marked atrophy of the surrounding structures, inability to raise the arm; the paralysis can be verified by electrical tests. When the arm cannot be directly elevated, *i. e.*, brought at right angles to the trunk, and later, when an appreciable space may be demonstrated between the humeral head and the acromion, it is evidence of the paralysis of the deltoid, whose nerve supply is the circumflex. When the outward rotation of the humerus is impaired, with excessive internal rotation, the infraspinatus muscle (the important external rotator muscle of the humerus) and the teres minor muscle are paralyzed; the former is supplied by the suprascapular nerve, the latter by the circumflex.

To attempt to dwell even in a cursory manner upon the subject of chronic arthritis would be impossible in an article of limited scope. Under this term are included a series of chronic degenerative changes, occurring at any age, mono- or poly-articular, impairing function to a greater or lesser degree, with more or less joint changes, and, in some instances, entailing great suffering. Any joint is likely to be attacked. Traumatism is a prominent factor in many instances. Infections may be the starting point of the articular invasion. At times, the deposit of urates at or within the joint eventually leads to joint disorganization. It is to be remembered that cartilage has a very limited power of repair, so that a common sequence of cartilage invasion is erosion. The original change in the joint may have its genesis in the synovial membrane, and it must not be forgotten that destruction of the articular cartilage may be secondary to the injury of the synovial membrane. Surgical writers classify these anatomic lesions of the joints as serous, ulcerative, ankylosing, formative and fungous.

The most common variety of chronic arthritis in the shoulder, however, is the traumatic; the result of injury in an individual suffering from an underlying infectious or toxic condition. In these cases there is tenderness over the great tuberosity and also in the axilla, some induration about the articulation, impairment of mobility, and the presence of crepitus.

The subject of shoulder disability is an interesting one and has attracted the attention and commanded much investigation and study from some of the best thinkers in the field of surgery. The labors of Codman and of Brickner are especially conspicuous in this connection, and for a concise and succinct presentation of the clinical forms of subacromial bursi-



tis, we quote from one of Brickner's excellent articles\* the following paragraphs:

"Codman's classification into three types, 'acute or spasmodic, subacute or adherent and chronic or non-adherent,' is unsatisfactory from the anatomic side, for in all cases, acute or chronic, the pathology is, I believe, the same—an adhesive bursitis. We cannot recognize, therefore, a non-adherent and an adherent type, nor it seems to me, can we make a satisfactory distinction under the titles 'subacute' and 'chronic'.

"In my experience the cases present themselves in the following forms which, however, are not to be sharply separated: acute, 'hyperacute', chronic, chronic with exacerbations.

"In acute cases, pain and stiffness develop rapidly and reach a maximum in about three days. The pain is quite severe and constant, and subsides little or not at all at night. The arm can be only slightly abducted without great pain. There is spasm of the shoulder muscles, increased by attempted abduction or internal rotation, active or passive.

"The term 'hyperacute' I use to indicate not so much the rapid development of the symptoms as their severity. The pain is very great. The patient hugs his arm to his chest, and the slightest attempt to raise it causes severe spasm. There is a rapid development of atrophy of the deltoideus and the spinati. Radiation of the pain into the fingers, with this atrophy, may deceive even a neurologist into the diagnosis of brachial neuritis. Indeed, the early appearance of atrophy of these three muscles suggests that there may be some associated localized neuritis; disuse for a short period seems not quite sufficient to explain it.

"In both the acute and the 'hyperacute' forms, tenderness at the point I have described is exquisite.

"Acute subdeltoid bursitis may gradually subside completely. More often it passes into the chronic form.

"Chronic subdeltoid bursitis begins in the acute form, or is of the same severity throughout. The pain is often annoying rather than unendurable. It may be quite intermittent, varying in severity. Often it is present only on certain motions (as in pulling on an overcoat sleeve, or attempting to comb the hair). Abduction may be limited to 45, 90, or 130 degrees; internal rotation may be much or little retarded. Passive movements are usually a little freer than active. External rotation is sometimes limited. In many cases the movements are perfect, but usually they are then more or less painful. Tenderness on pressure

over the lesser tuberosity is usually present and often great. There may or may not be atrophy of the deltoideus and spinati.

"This chronic form persists for months or years. Usually it subsides, with or without treatment, sometimes in spite of certain treatments. The lime deposit, if there is one, may gradually disappear completely.

"The 'chronic form with exacerbations' is of those cases, lasting for years, in which there is often a recession of symptoms, more or less complete, for long periods, but in which every few weeks or few months there is a severe exacerbation in which the symptoms approach those of the acute or even the 'hyperacute' form."

There is often considerable difficulty in instances of painful and disabled shoulders, in differentiating tuberculosis of the head of the humerus, from subacromial bursitis and allied conditions. For, in many cases of bursitis, not infrequently the diseased bursa reveals the presence of tubercle bacillus. Early in the tubercular infection there is localized pain over the head of the bone, loss of rotundity of the shoulder caused by flattening of the deltoid and fixation of the joint—due to muscular spasm and to the occurrence of ankylosis. There is always a primary lesion in some other part of the body. Abscess formation is a later expression of tubercular involvement. The employment of the *x*-rays as a corroborative measure is imperatively demanded.

Acromio-clavicular arthritis is difficult of diagnosis where ankylosis has formed and has been broken by traumatism. The *x*-rays furnishes the only sure means of arriving at a correct diagnosis.

It has been the desire of the writer to touch only superficially upon the surgical aspects of this important subject in so far as the more prominent surgical affections are responsible for the existence of painful and disabled shoulders.

On this account and in order to keep the subject matter within bounds and to present the dominant features succinctly, the writer has purposely omitted from consideration such arthritic conditions as are produced through toxins of many diseases. In this class we may include what may be broadly termed the many forms of infective arthritis: gonorrheal arthritis, influenzal arthritis, pneumococcic and typhoid arthritis. In this category may be scheduled rheumatic synovitis, commonly designated as "acute articular rheumatism" or as "acute rheumatic fever." The subject of arthritis deformans forms a separate chapter in itself.

218 SOUTH FIFTEENTH STREET.

\*W. M. Brickner, Pain in the Arm: Subdeltoid (Subacromial) Bursitis, *Journal of the Amer. Med. Assn.*, Vol. LXIX., October 13, 1917.



## RADIUM IN THE TREATMENT OF SARCOMA AND CARCINOMA OF THE BONE\*

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One of the worst things a surgeon sees is a true central or subperiosteal sarcoma of the bone. It appears so small and easy to remove, and yet from the first the outlook is bad. The possibilities of an operative permanent cure are so remote that one should not perform a radical operation until every means of a definite diagnosis have been exhausted, in order not to remove an arm or a leg for a benign tumor—as has been repeatedly done. For example, not many years ago, one of our eminent surgeons was prepared to operate upon a patient for a round-cell sarcoma of the thigh, when the patient decamped; he is alive and well to-day, the tumor later having been simply opened and drained. Up to the present time but four per cent. of cures have been reported following the radical operation, the common cause of death being metastasis to the lungs, and not a local recurrence. This raises the question of the importance of careful x-ray examination of the lungs and mediastinum in every instance before an operation, which I earnestly recommend, even in early cases, as the metastasis also takes place early. X-ray examinations of other bones of the skeleton should also be made, as the lesion may be metastatic, in spite of the fact that but one bone presents macroscopic signs of involvement.

For the past several years, but especially during the last year, we have tested out the efficacy of radium in sundry sarcomas of the bone, and in consequence, I am glad to say, we can now hold out a little hope, and certainly a greater one than when operation alone is resorted to. We have found that radium will sometimes destroy the disease and allow a new formation of healthy callus. The number of cases under observation and treatment is too small to cite percentages, but they are at least suggestive and lead us to hope for greater success in the near future as we continue to develop a more effective technique.

Three methods of treatment with radium which we have followed are: First, implantation or burying of radium emanation directly into the disease (from 1 to 3 millicuries) contained in minute glass capillary tubes, which are left permanently embedded. Second, massive treatments from the surface at a variable distance of from one to four inches with from one to four grams of radium. Third, laying bare the diseased tissue by operation and in-

serting, under inspection, a large amount of radium into the tumor, while the patient is under the anesthesia. Only with large amounts of radium can this last method be followed. The first method seems to be the most destructive to the local disease, and the most effective. Like the second, it is painless, it causes no severe reaction, and does not necessitate the patient's detention in the hospital, as in the open wound plan. Sometimes the three methods of treatment have been combined.

The approximate dosage for the needles, points, or spicules, as they are called, containing emanation, is 2 millicuries of emanation for each 4 cubic centimeters of disease for implantation; 5 gram-hours at 2 inches distance for each 3 square inches of surface, when treated from the exterior; one-half gram-hour direct treatment when placed under inspection in the center of the disease.

In almost every case we are fortunate enough to secure complete or partial relief of pain; this is the most striking result, and we feel that this alone well repays all our efforts. There is also a marked decrease in the swelling of the soft parts with increased function, a general improvement in health, and by x-ray examination, a redeposition of new bone. This change takes place in an interval of from two to five weeks.

The following cases are examples of the three methods:

F. J., married, white, lumberman, No. 6020, was first seen March 21, 1920, complaining of pain and swelling in his left shoulder, which had been injured by a fall four years before. This was followed by pain and stiffness, never severe, until the fall of 1919, when the pain became worse, and in November he had to stop work. There was marked swelling of the soft parts around the left shoulder and upper arm, but no reddening of the skin, the head of the humerus could not be felt, there was marked limitation of motion and the tumor felt solid. X-ray examination showed involvement of the whole of the head and upper third of the shaft of the humerus. The Wassermann reaction was negative. He suffered also from marked weakness and loss of weight. Radium was advised, and used, and three spicules, each containing 5 millicuries of emanation, were implanted at equal distances, about 4 centimeters apart, into the involved bone. In addition to this a total of 15 gram-hours radiation was given through the surface at 5 centimeters distance over three areas. In May, 1920, we noted a decided decrease in the swelling, and the pain was so greatly improved that he no longer had to resort to narcotics. Four more points, each containing 3 millicuries of emanation, this time were implanted as before. In July, 1920, another treatment was given entirely from the surface, using 15 gram-hours at 5 centimeters distance over three areas. In Sep-

\*From the Howard A. Kelly Hospital.



tember, 1920, a total of 11 millicuries of emanation, contained in four points, was implanted. By this time all the local swelling had gone, and the head of the bone could easily be felt, and mobility was greatly improved. He had been comfortable for the preceding three months, requiring no sedatives at all. An *x*-ray plate taken at this stage shows a definite deposit of new bone throughout the area of disease. general health has not improved *pari passu* with the local condition, which leads us to fear metastases, although we have been unable to demonstrate any by examination or *x*-ray plates.

I have been unable to get a report from this patient since November 1, 1920. At that time there had been no decided change in his general condition, but he had been quite free from pain.

M. G., female, white, married, age 57, No. 6494, was first seen June 18, 1920, complaining of pain in her back and paralysis of her legs. *X*-ray examination showed a destructive bone lesion of the eleventh and twelfth spinal vertebrae and areas of destruction on the fifth, sixth and ninth ribs on the right side. In 1900, she had an operation for chronic mastitis of the left breast. In June, 1919, she was operated upon for carcinoma of the right breast, and was free from all trouble until January, 1920, when she began having severe pain in the lumbar region, which was increased when she attempted to get up or move about in bed. She had been totally bed-ridden, and had lost practically the entire use of her legs for the past six months. She was treated with radium at regular intervals from June 20th to July 19, 1920, from 3 to 3½ grams of radium being used. The treatments were all given at a distance through the mattress of the bed with the patient lying on her back, as she was unable to sit up or lie on her side on account of pain. She was again treated daily in a similar manner from September 18th to September 21, 1920. When examined this time, she was found to be entirely free from pain, and the muscular power of the legs showed great improvement, but she could not stand alone. Her general health was excellent. *X*-ray examination showed a definite filling in of callus in the lone lesion on the two vertebrae. A plaster jacket to support the spine was made, after which she was able to be out of bed and to walk with assistance. She returned December 1, 1920, still wearing the jacket. Her general health is excellent and she can walk a mile. No pain. *X*-ray examination shows the vertebrae apparently solid, and no areas of erosion can be seen. The jacket has been discarded, and she will wear steel supports embedded in the corset.

C. C., female, white, age 16, No. 4175, was first seen June 28, 1918, complaining of pain and swelling in the right knee. She had a fall in 1916, which was followed two months later with pain on motion of the right knee joint. She was treated for rheumatism, but the pain and limitation of motion increased, and a definite swelling developed in the soft parts. An *x*-ray diagnosis of sarcoma of the lower end of the right femur was made. The Wassermann reaction was negative. In February, 1917 an open

operation was performed and a thorough curettage done, after which she wore a cast for eight weeks. The pathological diagnosis was giant-cell sarcoma. There was a definite recurrence in the fall of 1917, and a second operation was performed, similar to the first. She was fairly free from symptoms following this operation until May, 1918, when there was evidence of a definite recurrence. When first seen in June, 1918, there was considerable enlargement of the right knee, the bony prominences were obscured and there was marked limitation of motion, with increased pain. There are scars of the previous operations, but no reddening of the skin. *X*-ray examination showed involvement of both condyles of the femur and the adjacent shaft of bone. Radium treatment was given at regular intervals from June, 1918, to July, 1919, over four areas around the joint at 5 centimeters distance, three grains of radium being used each treatment. From the first there was disappearance of the pain, and a decrease in the swelling of the soft parts. During this time she walked comfortably with the aid of a crutch. The first part of July, 1919, she sustained a pathological fracture of the inner condyle of the femur, and, in addition, the *x*-ray plate showed active disease. An open operation was performed July 11, 1919, and the diseased bone thoroughly curetted away, and 2 grains of radium placed under inspection into the center of the cavity and left for twenty minutes, with the patient under the anesthetic. A plaster cast was applied for seven weeks, and then motion was encouraged. Since then she has been walking without assistance. There is still limitation to a small degree of extension and flexion. This inconveniences her very little, and for the past six months she has been doing gymnasium work. An *x*-ray plate made six months ago shows definite formation, and no evidence of disease. When last heard from, the latter part of November, 1920, she was having no symptoms whatever from the trouble.

1418 EUTAW PLACE.

#### RESTORATION OF JOINT FUNCTION.

In fractures nearby or at distance from joints, convalescence is often prolonged by damage due to inattention to the joint while treating the fracture. Muscles and tendons become atrophied from non-use. It is not uncommon to see an extreme toe-drop in a patient on crutches after treatment for a fracture of the leg or thigh, or a wrist-drop after a patient has recovered from a fracture of the forearm. Muscles and joints should be kept in as nearly normal condition during the treatment of adjacent fractures as possible. This can be done by massage and manipulation without disturbance of the seat of fracture. Such treatment tends to promote circulation of the blood and, as a result, more rapid healing.—CUNNINGHAM WILSON in the *International Journal of Surgery*.



## THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM.

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(Continued from the January Number.)

### IV. SURGICAL PROCEDURE IN THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM.

The operation now most frequently used for correction of the deviations of the nasal septum which we have described in Section III. and which are remediable by surgery is an outgrowth of the work of Killian, Ballenger, Freer, and others in the early years of this century. In the last decade the technique has been perfected by improvement and adaptation in the tools used, by modification of the incision as the result of experience, greater care in the selection of cases, and a lowering in the time of the operation. Operators specializing in this field lay increased emphasis on a knowledge of the anatomy, circulation, and neurology involved in a favorable prognosis. It is because of progress in these inter-related fields that the technique of this operation has reached the stage of perfection now attained.

The present day submucous resection operation superseded the earlier crushing and sawing operation of Asch and others. The older operations were productive of great shock with consequent traumatic disturbances, sometimes of long continuance. They were too often followed by hemorrhage, and destroyed excessive amounts of membrane with the consequent pathologic phenomena of scar tissue and poor drainage. The post-operative treatment by plugging was painful and sometimes indefinitely prolonged.

The septum, as we have said in Section I, is composed of a triangular cartilage with a supporting bony framework made up of ethmoid above and vomer below. This cartilage fits into the septal plate of the ethmoid, the vomer, and the intermaxillary ridge by means of a groove, half moon in shape, the seat of growths and adhesions under pathological conditions. It is here that injuries to the bone cause significant alterations, and it should be noted that the cartilage under ordinary circumstances sends out spurs from this groove, some apparently normal, others individual and pathological. The posterior edge of the septum is attached to the vomer, while the tip of the nose and the nasal ridge are the limits of the under surface. This septal cartilage is cover-

ed with a highly vascular mucous membrane of columnar epithelium. The area has an abundant blood supply, part from the naso-palatine arteries, from the nasal branch of the ophthalmic artery, the septal branch of the labial artery, and from a small branch of the facial artery which perforates the nasal bone and further supplies the anterior part of the septum. Because of the extent of the blood supply there is little danger of the parts becoming necrotic.

The indications calling for operative procedure in deviations of the septum have already been described in Section III. The procedure described in this section is observed in ordinary cases of curved or S-deviations, with no sharp angles. The operation calls for local anesthetization and is usually performed with the patient in a sitting posture. The following instruments are necessary: a reflected light; a small scalpel; a nasal speculum; a packing speculum; Dunning's combination curette elevator; a Ballenger swivel knife, punch forceps, (two styles); a small chisel and mallet.\*



Instruments necessary in submucous resection of septum.

The patient, who should have spent the previous night in the hospital or under equally quiet conditions, is seated and his nose cleansed for anesthetization. It is impossible to cleanse the nose thoroughly because of the many openings, but we are aided by the fact that the nose is singularly free from infection. Unless there is indicated some idiosyncresy to cocaine, that drug is used as anesthetic. A nervous condition in the patient will predispose to cocaine poisoning; for this reason the writer prefers a weak solution, about equal parts of cocaine, 10%,

\*Yankauer says that the ingenious Ballenger swivel knife, like the original cartilage knife of Killian, leaves a strip of cartilage on the crest. To obviate this he uses a hook-shaped separator, with a pair of forceps with hollow blades to cut the cartilage. The writer has found that this strip presents no particular difficulty, as it can be removed with ease by a curette.

and adrenalin chloride 1-1000. If anesthetization takes longer than the average of about 20 minutes, weaken the solution to 4%. Ballenger and Freer reduced the time for anesthetization by the use of pulverised cocaine with a 1-2000 solution of adrenalin. This reduces the time; but the writer believes that many of his colleagues will agree that the economy of time is made at the grave danger of cocaine poisoning from drifting crystals, when the powdered cocaine is used.

Complete and speedy anesthetization may be induced by care in the placement of the saturated plugs. Place the first plug, thoroughly moistened, high under the superior turbinate. This is often difficult because of the shape of the nose. Lay the next plug

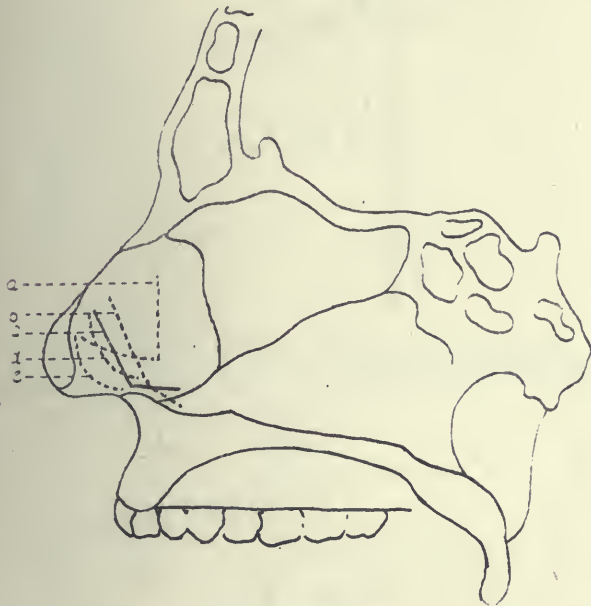


Fig. 5. Diagrammatic representation of incisions—(a), Freer; (b), Yankauer; (c), Dunning; (d), Killian; (e), Hajek.

above the lower turbinate and on the middle turbinate. Place the third as far underneath and posterior to the lower turbinate as it can be placed, well back toward the pharynx, leaving a generous length to fill the anterior parts of the nose. The skin of this part of the nose is affected through the circulation. Injection is never necessary if adequate time and care are given to this stage of procedure.

Much of the success of anesthetization is dependent on the careful orientation of these saturated plugs. If we recall the nervous system of the nose we know we are to reach the nerves above coming in from the cribriform plate as well as the ganglia of the sphenopalatine system. The second and third packings are so placed as to carry the cocaine posteriorly. In that region the septum is completely cov-

ered,—and is bleached and hardened by the process to the consistent texture of a linen handkerchief, or perhaps better, of a tanned hide.

After anesthetization is complete, the plugs are removed and the surgical procedure is initiated by incision. For convenience and therefore for speed and dexterity, the incision is made on the left side.

Much of the content of the earlier literature dealing with this operation on the septum is devoted to the character and position of the incision, or incisions. The old incision made at the tip of the nose is known as the Hajek incision; (Fig. 5) the one at the junction of the vestibular skin with the mucous membrane, the Killian incision. The latter incision



Fig. 6. Showing position of patient and scalpel at moment of incision.

was used by Ballenger except when the septal cartilage was deflected at the tip, when he used the Hajek incision. Krieg had made a U-shaped flap with three incisions. But observation of the secondary results of this operation showed that the problem was to avoid scar tissue that would interfere with one of the main functions of the septum, to facilitate the drainage accomplished by the capillary attraction between the secretions and the ciliated epithelial surfaces. If a thick horizontal band of squamous epithelium is formed by the operation, the flow of mucous is impeded, dries, and forms crusts. This called for the reduction to a minimum of the amount of scar tissue. Other modifications of the earlier incisions were concerned with the avoidance of perforations. It had been found that the largest number of these perforations had taken place with the flap incision. Hajek had made a single curved incision in the mobile septum along the anterior edge of the cartilage; but his operation left the dorsum of the nose supported by a strip of cartilage whose only attachment, the notch between the nasal bones,



was very weak. Killian had made a curved incision in front of the deviation with the convexity forwards. But in the more severe deviations the management of the lower part of the septum is "most difficult," to use his own words.

Years of operating have taught the writer that the most successful operations result from a vertical incision anterior to the white line appearing very distinctly in the anesthetized nose, at the point of junction between the mucous membrane and the true skin. This line, anterior to the Killian incision, is used as a guide in order to get a tougher membrane and to remove the anterior deviations if they exist.

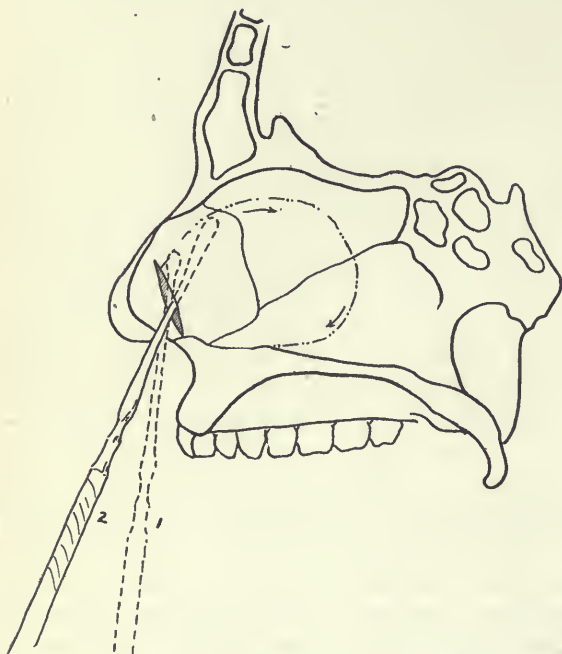


Fig. 7. Showing positions of curette elevator. (1) curette end; (2), elevator end; dotted line of direction with arrows indicates direction taken by instrument in loosening membrane.

In making this incision, the knife is inserted through the mucous membrane, to, but not through the cartilage. The cut is started about  $\frac{1}{4}$  of an inch from the roof of the nose, and prolonged downward to the floor and outer wall, the deep L-incision being completed at the close of the operation for drainage purposes, and to lessen the danger of atresia. (Fig. 6)

The incision made, we elevate the muco-perichondrium from the cartilage by the use of the curette end of the elevator. This blunt instrument is safer, in order to avoid tearing. Starting at the highest angle of the incision and changing to the flat end of the elevator, we push gently backward, upward, then downward. (Fig. 7) In the majority of cases we are able to separate the mucous membrane from the

cartilage, from part of the perpendicular plate of the vomer, with this stroke from behind forward. Then scraping through the cartilage at a point posterior to the incision and near the lower limit of the cartilage, as illustrated in figure 8, turn the curette so that its back lies on the membrane and scoop out the cartilage by a forward and upward stroke. This process should



Fig. 8. Showing curette scooping cartilage in cavity at beginning of operation.

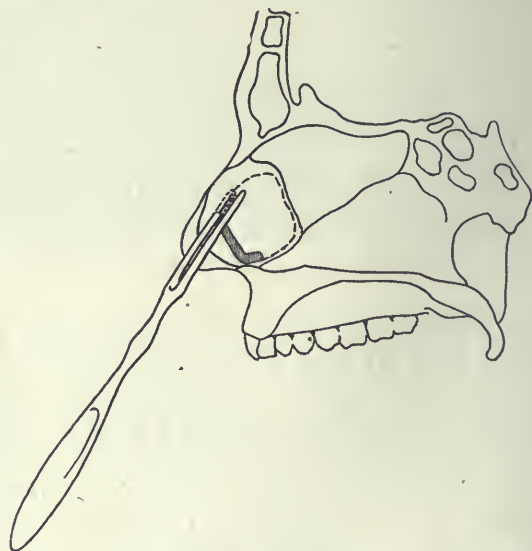


Fig. 9. Showing position of Ballenger swivel knife at point of entrance. Dotted line shows direction taken by knife.

be completed along the line posterior to the incision in order to avoid perforation opposite the incision at that point, if one was unfortunate enough to go through the membrane of the opposite side. The next stage is the complete separation of the muco-

perichondrium from the septum on the opposite side, with the same procedure. When this is done the deflected cartilage may be removed either with the Bal-lenger knife or with forceps. (Fig. 9) The operator should use great care at this point to avoid any use

of the cartilage in the way described, a cutting forceps is next inserted through the incision. Bite with this forceps through the junction of the perpendicular plate of the ethmoid with the cartilage at the highest point. (Fig. 10) The surgeon must exercise great caution at this point to avoid fracture of the cribriform plate,—a danger against which one can easily



Fig. 10. Showing use of punch forceps after removal of cartilage and starting removal of bony structure.

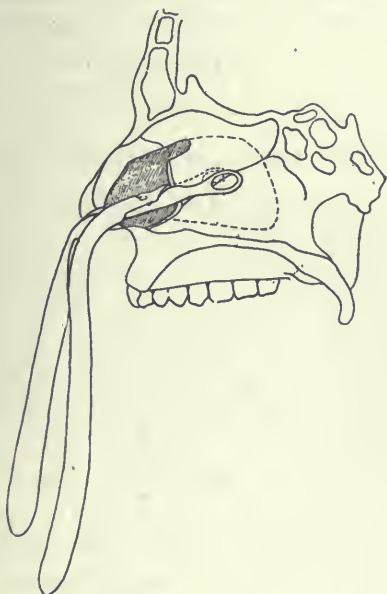


Fig. 11. Continuing figure—at late stage in removal of bone by punch forceps.

of force, in order not to dislocate the septal cartilage from the lateral cartilages and the nasal bones which aid in the formation of the bridge of the nose.

If the deformity is not corrected by the removal

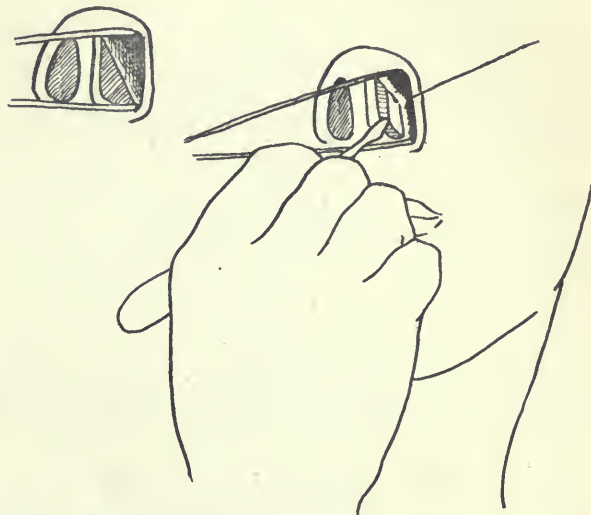


Fig. 12. Diagrammatic explanation of procedure with speculum and scalpel in place in separation of membrane from bone on floor of nose preparatory to removal of portions of intermaxillary ridge.

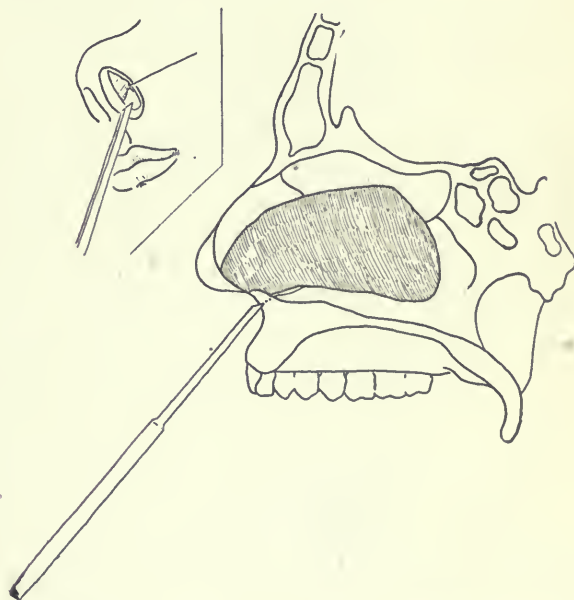


Fig. 13. Showing procedure with chisel and mallet in removal of intermaxillary crest.

guard. The perpendicular plate of the ethmoid and any part of the vomer causing obstruction is removed (Fig. 11) with the aid of a punching forceps. The incisor crest usually causes more or less obstruction;



here also is often found a large amount of fibrous tissue and adherent membrane, especially at the junction of the perichondrium and the periosteum. After the cartilage lying above is removed, these may be separated by a sharp knife, if one will remember to keep the sharp edge of the knife on the incisor crest. (Fig. 12) The incisor crest is then removed with a

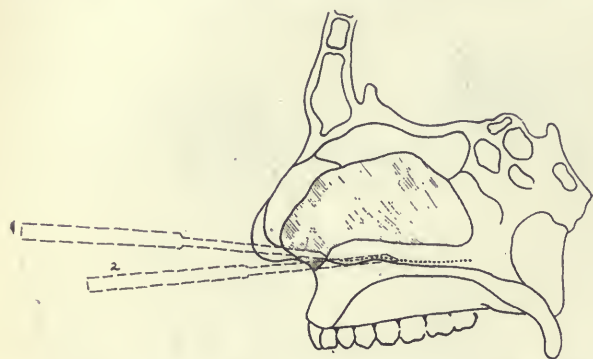


Fig. 14. Showing later stage of procedure with mallet and chisel in removing portion of maxillary ridge; (1) and (2) show instrument's change of position—Chisel not driven so far usually, as indicated in diagram.

chisel and mallet. It should be remembered that the incisor crest extends well forward; if, therefore, the chisel is inserted well down on the crest and driven upward it will separate with the exertion of very little force. (Fig. 13)

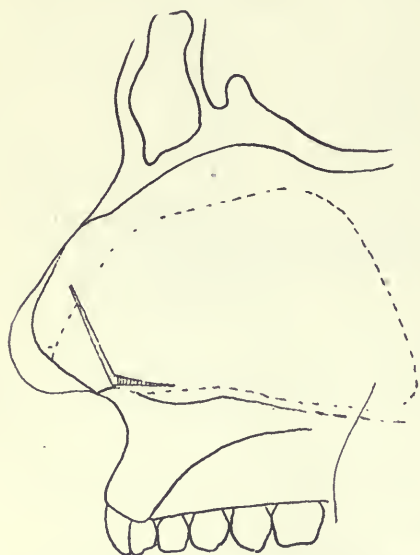


Fig. 15. Diagram showing completion of L incision.

On the removal of the incisor crest, together with the other bony and cartilaginous portions of the septum, there is left a roomy opening between the membranes. The operator has now to deal with the intermaxillary ridge, which is thin below its junction with the triangular cartilage. If the chisel is inserted so

that it reaches the ridge, with one or two slight taps the bone can be fractured for considerable distance posteriorly. (Fig. 14) It is then easily removed with a curette or with forceps.

The division of the membrane is now continued at its outer angle for a little more than 1-3 of an inch posteriorly, to facilitate drainage and relieving danger of atresia. Replace the mucous membrane on the septum. The sac is thoroughly cleansed, the blood clots and any remaining small pieces of cartilage and bone are removed. The septum is lined to see if there is any remaining deviation; if not, the membrane is replaced in position. (Fig. 15) It will be found that the membrane has contracted; because of this there is but little danger of hematoma. The healing process will be aided by the drainage at the end of the L-incision.

The surgical procedure in an uncomplicated case of curved deviation is now complete. The nares are packed with vaseline gauze, which is left in place for twenty-four hours. Care should be exercised in packing that the gauze is placed not too far posteriorly, in order to avoid irritation of the Eustachian tube and also to avoid follicular tonsilitis. After the removal of the gauze, the patient is instructed to insert white vaseline in the nose. A few crusts will form; these should be removed about once a day. There is little reaction from this operation, and the patient is usually able to return to his ordinary pursuits in about 48 hours after the packing is removed.

(To be concluded)

#### SYPHILIS IN THE NOSE THROAT AND EAR.

Conditions of the mouth, throat and larynx which may be due to syphilis are tumors, ulcerations, perforation of the soft palate, deviation of the tongue, Hutchinson's teeth, high arched palate, chronic laryngitis, and paralysis of one or both vocal cords. Perforation of the soft palate and paralysis of the vocal cords are extremely likely to be of luetic origin.

Perforation of the septum of the nose is very likely to be due to syphilis. Also tumor formations and ulcerations in the nose should be considered as possibly due to this disease. The saddleback nose deformity is especially suggestive of hereditary syphilis.

Sudden loss of hearing without pain and with tinnitus, in a young man, would suggest the almost certainty of syphilitic involvement of the eighth nerve and labyrinth.—J. D. WILLIS in the *Virginia Medical Monthly*.

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**WALTER M. BRICKNER, M. D., F. A. C. S., Editor.**

NEW YORK, FEBRUARY, 1921.

## RADIOTHERAPY IN CANCER.

It is quite unnecessary to recite the limitations and disappointments of surgery in the treatment of malignant neoplasms. In the search for remedies to supplement or, better, supplant surgery in these affections, it is interesting to note the developments that have taken place in the field of radiotherapy, and the increasingly favorable results that have been reported as its technics have improved.

The beneficent effects of radium in carcinoma of the cervix uteri were some years ago demonstrated by Howard Kelly, who also established that radium often acts like magic in lymphosarcoma and Hodgkin's disease. The "radium pack" and, especially, the implantation of radium emanation needles, appear to be accomplishing good results in some cases of cancer elsewhere situated. Even in cancer of the tongue—in which the results of surgical treatment are notoriously bad—the effects of radium emanation implantations are said to be "encouraging."

The most striking recent advances in radiotherapy of which report has come to our notice are described in the account published by Sittenfield (*Journal of the A. M. A.*, January 8, 1921) of his observations of roentgen therapy of cancer as practiced now in Germany. The technic, he reports, has undergone great changes. More powerful x-ray apparatus, and new

type tubes of high-tension voltage are employed; and "in particular, accurate measurements have been established, thus making possible exact dosage in carcinoma, sarcoma and benign tumors." The modern roentgen apparatus he found in use operate with an intensity of 180 to 220 thousand volts, and it requires 25 mm. of lead to absorb the hard rays produced by it. Much greater penetration is possible with these more powerful machines and improved vacuum tubes, and, too, it has been made possible to determine the exact dosage, dispersion and absorption coefficient. It is important, Sittenfield records, that all parts of the tumor receive the same homogeneous radiation, preferably in one sitting.

With the more powerful apparatus and accurately estimated dosages, x-ray treatments occupying six to eight hours at a time (raying four to seven fields) are administered in the gynecological clinics of Bumm (Berlin), Seitz and Wintz (Erlangen) and Opitz (Freiburg). At Freiburg, says Sittenfield, no cancer of the uterus had been operated upon since January 1, 1919. Wintz reported to him that he had radiated 3,000 cases of uterine cancer in the past 7 years and that of the cervix cancer cases 45% were alive after four years! Opitz had treated 41 cervix cancer cases, of which 22 had receded, 10 were not influenced, and 9 died. "Receded" is a term rather too vague for one who would wish to learn whether there were any cures.

The surgical treatment of neoplasms is purely mechanical; it aims to remove all the affected tissue en masse. Radiotherapy is an empirical treatment; it aims to destroy the tumor cells in situ. There is no present reason for believing that either of these methods—and they are the best now at our disposal—or the combination of them, will ever become the long-sought cure of malignant growths. Before a specific therapy can be evolved we probably shall have to know much more concerning the cause of neoplasia and the nature of malignancy—both of which are problems that have baffled the many great minds that have struggled with them.

## Surgical Suggestions

Do not attempt a radical operation for malignant growth before excluding as far as possible—by physical signs or (and) roentgenography—the presence of a distant metastasis. Cancer of the breast and the prostate usually metastasises in the spine and the lungs; cancer of the rectum, in the liver; hypernephroma, in the bones; sarcoma of the bones, in the lungs.



An ulcerating lesion upon the hand or foot should always be suspected of epithelioma, just as much as one would suspect such a growth upon the face, where it is more common. It may proceed from an irritated wart or keratosis. Before deciding on radium or  $x$ -ray treatment in preference to excision, be sure that there is no evidence of lymph-gland extension.

An acute effusion into the joint of a child, with fever, pain, and redness, swelling and bone tenderness extending beyond the joint, arises from an epiphysitis—or, more properly, a juxta-epiphyseal osteomyelitis. The lesion is most common in the lower end of the tibia. Do not be in a hurry to operate in this type of osteomyelitis; it often recedes spontaneously. When the symptoms have subsided continue to keep the child in bed or protect the joint by a plaster cast.

The most common cause of pain in the upper arm is subdeltoid bursitis. With it there may be great, moderate or only slight loss of shoulder function—pain on motion. Pain referred to the shoulder itself is not essential to the diagnosis.

The  $x$ -ray shadow of a lime deposit beneath the subdeltoid bursa may be found in shoulders that give no symptoms. *Per contra*, in cases of undoubted and severe subdeltoid bursitis the lime deposit is often absent.

The first and most important step in the treatment of subdeltoid bursitis with limitation of shoulder movement is to secure abduction of the arm by graduated elevation and relaxation in bed. When fair abduction has been thus accomplished continue the treatment by means of light Indian club exercises. Immobilization in these cases is bad treatment.

Those who do not know that the lymph glands in the parotid region may be the seat of tuberculous infection are apt to mistake the swelling caused by such an involvement for a parotid tumor.

In cases of hyperthyroidism improvement or even apparent cure while the patient remains in the hospital is not conclusive evidence of the beneficence of the treatment, whether it was by surgery, medicine or the  $x$ -ray. The symptoms may, and often do, recur when the patient returns to the environment in which they developed.

## Progress in Surgery

Selections from Recent Literature

H. Lyons Hunt, F. R. C. S., Abstract Editor

**Are There Reliable Criteria of Operability in Exophthalmic Goiter?** DAVID CHEEVER, Boston. *Archives of Surgery*, January, 1921.

The author discusses the disadvantages of operative procedure under three heads—

1. The associated mortality.
2. The ordeal of the operative experience.
3. The scar.

As the first is the only one deserving serious consideration in expert hands he suggests that by the consideration of the following points the resistance of the patient to operative trauma may be determined—

1. The history, with special reference to the age of the patient, the degree of asthenia, the loss or gain in weight, and the presence or absence of a "wave" of hyperthyroidism.
2. The general clinical picture, including as an important factor, the mental attitude.
3. The presence or absence of organic disease of the heart and other viscera, especially the kidneys, liver, and the cerebrum.
4. The presence or absence of an enlarged thymus.
5. The blood pressure.
6. The pulse rate.
7. The epinephrin test.
8. The administration of thyroid extract.
9. The determination of the basal metabolism.
10. The manner in which the patient withstands the strain of preliminary procedures involving psychic disturbances or surgical trauma.

Classifying cases in accordance with Means and Aub—into vagotonic and sympathetico-tonic, (type 2 and type 1) respectively, and after careful consideration of these enumerated headings and the citation of ten cases, Cheever summarizes as follows—

Can satisfactory deductions be drawn from these cases to assist in determining reliable criteria of operability? The suggestion of Means and Aub that patients falling into their Type 2 ("vagotonic" group) give a more serious prognosis, does not seem to be wholly sustained by the cases studied. Of the four fatal cases, two belonged to the "sympathetico-tonic" and one to the "vagotonic" group, while one showed different phases, permitting its classification in either group. Of the others, four cases showed very serious post-operative reactions, and of these, three can be classified as "vagotonic" and one as "sympathetico-tonic". The remaining patients, two cases were "vagotonic" in type with high metabolism, but both made good recoveries without undue reaction; the operation being ligation in one and the radical procedure in the other. Evidently an investigator with a theory to defend could find in these cases support to either point of view. Perhaps the weight of evidence favors the impression that the "vagotonic" group gives the more serious prognosis.

As far as these cases go, no definite level of pulse or metabolism can be said to constitute an absolute contraindication. One death occurred in a patient with a metabolism as low as +33. It is certainly striking that three of the four fatal cases were those of Jewish women, since in a series of cases of exophthalmic goiter at Peter Bent Brigham Hospital, the proportion of Jewish women was less than one-fifth. It seems worth while to allude more specifically to the possibly very great importance of testing a patient's ability to withstand operative trauma by one or more preliminary minor procedures. (No comment is intended to be made in this paper on the therapeutic effect of these measures, although they are usually, of course, designed to lessen the thyrotoxicosis). Such a point of view is mentioned by many writers. Watson says that preliminary injections of saline solution or sterile water should be made into the gland "to raise the patient's threshold of stimuli, thereby preventing an



acute attack of hyperthyroidism which might otherwise follow the first quinin and urea injection." Sistrunk speaks of ligation as a means of testing the ability of the patient to stand any operative procedure without precipitating a severe crisis of hyperthyroidism.

It seems reasonable to offer the subjoined tentative conclusions with regard to criteria of the ability of the patient with exophthalmic goiter to withstand the strain of operative therapeutics:

1. During an acute exacerbation of the disease, or in periods of great mental depression, operation is contraindicated.

2. Muscular weakness so great that the patient cannot walk and marked loss of weight with continued loss under absolute rest are serious contraindications.

3. Organic visceral disease so serious as to jeopardize patients having any operation of similar technical type is a contraindication.

4. Operation should not be undertaken in the presence of an enlarged thymus, until its probable activity has been reduced by irradiation.

5. The Jewish race offers a distinctively higher operative mortality.

6. A metabolism of +30 introduces a serious risk, which undoubtedly increases with high rates, but not necessarily in proportion, and there is no rate of metabolism which alone contraindicates at least minor surgical procedures.

7. The "vagotonic" type is possibly more vulnerable to the operative ordeal than is the "sympathetico-tonic", but evidence on this point is as yet inconclusive.

8. The minor procedures, whether consisting of injections into the gland, cauterizing or ligating operations, are often most valuable indices of a patient's resistance to trauma.

In hyperthyroidism, operations will always be attended by a peculiar factor of danger, not present in other operations that are technically similar.

**Radium in Toxic Goiter.** W. H. B. AIKINS, Toronto.

*American Journal of Roentgenology*, November, 1920.

The author reviews the outstanding features of toxic goiter—also the etiology—which he gives as following: (a) The psychic causes, which include fear, shock, or other violent emotions; (b) Infected foci, e. g., tonsils, adenoids, etc.; (c) hyperactivity of other endocrinous glands, present, for example, at puberty, pregnancy or the menopause.

His report is based on a series of about 100 cases treated by radium, in addition to the usual medical treatment, and he is convinced of the value of radium treatment in preference to surgery. He gives the following grouping of cases: Group 1, mild toxic goiter, as seen in adolescence. Group 2, grave toxic goiter with enlarged gland. Group 3, grave toxic goiter with little or no enlargement of the thyroid gland. Comparing the superiority of radium to that of the x-ray, he quotes Dawson Turner who says, "As compared with x-rays in the treatment of this condition, radium has the following advantages: (a) absolutely constant emission of rays and therefore exact dosage possible; (b) far greater penetration of its rays, so that the deeper parts of the gland are reached; (c) no noisy exciting apparatus so that the treatment can be applied at the bedside without in any way disturbing the patient. The words *cito, tuto, et jucunde* can fairly be applied to the radium treatment of exophthalmic goiter." G. S. REITTER.

**Malignant Adenopathy of Bones of the Foot, Probably of Thyroid Gland Origin.** HERBERT H. BROWN, Rochester, N. Y. *Journal of the American Medical Association*, December 25, 1920.

Brown cites the case of a woman, aged 40, who at 31 had the thyroid gland removed and was told that the gland contained a tumor. Her health was good for five years when she began to suffer from lumbago and a very tired feeling. Shoes worn at about this time were too small, and the toe was pinched. Later the toe became inflamed and then "broke down," but finally formed granulation tissue and healed. Later throbbing, dull pains were noticed in the toes of one foot, and a roentgenogram at that time disclosed a distinct loss of bone substance of the toes, four of which were removed at two operations. After about a year and a half a swelling was noted on the dorsum of the foot, and on the

right ankle. The tumor mass was soft and painless to palpation and also to the needle. The roentgen ray disclosed a definite loss of bone substance of the fibula and the fifth metatarsal bone, with little or no involvement of the joints. Roentgenograms of all the other bones of the body were negative. A diagnosis of a bone tumor of probable thyroid origin was made. The great toe was amputated for pathologic diagnosis, and sections showed a malignant and rapidly growing adenoma. Following the histologic studies, the leg of the patient was amputated by Dr. Prince at a point several inches above the tumor masses shown in the roentgenograms in the hope that the neoplasm might be primary at this site rather than metastatic from the thyroid gland tumor that was reported to have been removed some seven years previous. In none of the sections was it possible to find colloid deposits, so it is impossible to state that the neoplasm is derived by metastasis from the tumor of the thyroid reported to have been found.

**Carcinoma of the Prostate.** A Clinical Study. H. C. BUMPUS, Rochester, Minn., *Surgery Gynecology and Obstetrics*, January, 1921.

The author states that the comparatively recent introduction of radium as a therapeutic agent has centered medical interest around the various aspects of the treatment of carcinoma of the prostate, and current literature abounds with cases thus treated, whereas the frequency of the disease, the clinical findings, the results of its surgical treatment and the prognosis were almost established facts which the occasional atypical case but served to emphasize. Now the entire progress of the disease has become altered by the therapy and all the various phases are opened again to new investigation. This study deals with metastasis and is based on 362 cases of carcinoma of the prostate, observed at the Mayo Clinic during the years 1914 to 1919 inclusive. Of these, 79, (21 per cent.) show metastasis.

A review of the lymphatic drainage of the prostate is given, with the following metastases occurring—in glands, 37; inguinal glands, 20; iliac glands, 12; cervical glands, 9; (left cervical, 7), and retroperitoneal glands, 5.

*Glandular invasion* may be very extensive without giving physical signs and not demonstrated clinically, often until the glands have enlarged sufficiently to become palpable through the abdominal wall or through the rectum.

Pain was present as an early symptom in 34.1 per cent. of these cases.

Pathologically, cancer of the prostate may be primary in the gland; more frequently it is associated with simple hyperplasia. Clinically, two fairly typical types occur: Type 1. Slight enlargement of the gland with very few local symptoms, and often discovered only because of symptoms produced by metastasis. Even in the late stages, the gland does not enlarge extensively. The characteristic stony hardness is usually absent. Microscopically, this type shows cancer cells scattered throughout a somewhat increased fibrous stroma and almost no tendency to glandular formation. Type 1 is far more malignant than type 2. Type 2 is the more common type, showing any degree of enlargement of the gland—but the topography of it is always the same. Its contour is irregular and has a characteristic stony hardness even when the masses are palpated through normal or hypertrophied gland. It spreads upward into the vesicles—either uniloculate or bicornate—and often causes rectal obstruction. Microscopically, type 2 shows cuboidal, columnar and undifferentiated cancer cells crowding poorly formed gland acini or breaking through into the stroma.

Type 1 offers a graver prognosis to radium therapy than type 2.

*Osteoplastic and Osteoclastic Metastasis.*—A review of the literature and table of the cases of metastases to bones found at necropsy are given, also tables of incidence of metastases in this series of cases which show that 41 cases, or 51 per cent., of the 79 cases with metastasis had bone involvement and that 30.3 per cent. of the 135 cases x-rayed showed bone metastasis. Of the above cases that were x-rayed 30 showed bone metastases to the pelvis, 24 to the spine, 6 to the femur, 6 to the ribs and 3 to the lungs.



Other metastases were spinal-cord, 8, and 40 cases which had only a single metastasis as follows: Pelvis, 9; inguinal glands, 7; cervical glands, 5; spinal cord, 5; iliac glands, 4; spine, 3; ribs, 2; femur, 2; retroperitoneal glands, 1; skin, 1; liver, 1. Various clinical manifestations are discussed with symptoms and urinalyses. The type of gland and not the presence of metastasis determine the course of the disease, type 1 being undoubtedly shorter than type 2.

**Conclusions**—1. Metastasis to the glands probably occurs more frequently in cases of carcinoma of the prostate than is demonstrated clinically because of the inaccessibility of the glands first involved. 2. Two distinct types are distinguishable clinically and microscopically. 3. The smaller type of carcinoma gives clinical and microscopical evidence of greater malignancy. 4. The large type tends to remain localized, resulting in urinary symptoms and producing metastasis later in the disease than the smaller clinical type. 5. The larger clinical type is more amenable to radium therapy because of its lesser potentiality of malignancy. 6. One-third of the patients with carcinoma of the prostate have osseous metastasis demonstrable by the x-ray. 7. The pelvis and spine are the most frequent sites of osseous metastasis. 8. Metastasis to the lung rarely occurs—probably never alone. 9. Metastasis to the spinal cord closely simulates primary cord tumors and often occurs when the prostate is but slightly damaged. 10. Pain is absent in one-fourth of all cases with metastasis. 11. Urinary symptoms are absent in 11.5 per cent. of all cases with metastasis. 12. Neuralgic and rheumatic pains in men above middle age—even in absence of urinary symptoms—should suggest the possibility of carcinoma of the prostate.

G. S. REITTER.

#### The Rationale of Radium Therapy in Cancer. ISAAC LEVIN, *The New York Journal of Roentgenology*, November, 1920.

By a series of observations and experiments the author establishes the fact that the biological effect of the rays from radium and the x-rays differ within the various tissues of plant and vertebrate animal organism. He defines "selective action" as meaning that the identical rays act differently on different tissues. He cites the selective action of radium on the lymphocytes in lymphatic leukemia and shows that myelocytes in myelogenous leukemia are rapidly reduced by radium, while the myelocytes in the blood of cases of skeletal metastasis of carcinoma are not influenced by the rays. Through the myelocytes in these two conditions are morphologically identical, they differ biologically.

By "selective absorption" is meant that the same tissues may destroy or "absorb" one type of ray and not influence another—as for example, the effects of the different rays on the skin.

Only by arriving at a true understanding of both the phenomena of "selective action" and "selective absorption" can a correct valuation be placed upon each, and will the best type of ray, methods of filtration, and correct distance be applied in therapy. The effect of radium on cancer is a "selective action." Microscopically, cancer tissue shows degeneration of the cells—consisting of vacuolation of the protoplasm, pycnosis of nuclei, karyolysis, and ultimately complete necrosis of the cell. These cellular changes are accompanied by a round cell infiltration, which is subsequently changed into dense sclerotic connective tissue, poor in bloodvessels. This new connective tissue formation ultimately dominates the picture to such an extent that some observers maintain it is the only direct effect of radiation. To show that this is true, the author cites his experiments on crown gall. The role of the newly formed connective tissue is that of a protective barrier around the cancer.

Levin shows that skeletal metastasis usually begins development within the bone marrow. Two types of changes occur—osteoplastic and osteoporotic and that radium therapy enhances the healing power of the organism, destroys a major part of the malignant tumor and surrounds it with newly formed bone.

Buried emanation by correct technique will, in the near future, supersede the external application of radium in combination with incomplete surgery and become the

method of choice in many conditions—though it should always be accompanied by external application in the areas of the regional lymph glands and areas directly adjoining the tumor. Repeated properly selected doses are to be preferred to one intense dose, followed by another application at a longer interval. The presence of "stunned" cells would seem to indicate the above preference for repeated smaller doses.

**Conclusions**—Radium is the most powerful agent in the whole therapeutic armamentarium of medicine and its selective action presents a most remarkable phenomenon. (2) It is gradually dissipating the feeling both within the profession and the laity that a diagnosis of cancer means a death warrant. (3) Each radium establishment which controls large quantities of element should become a center of cancer research.

G. S. REITTER.

#### Stasis and Prevention of Cancer. A. C. JORDAN, *British Medical Journal*, December 25, 1920.

In an address delivered before the Hunterian Society, the speaker made the following suggestions to prevent the occurrence of cancer:

1. Avoid stasis in general, with its attendant toxemia; in other words, keep all the tissues healthy.
2. Avoid sources of local irritation in the alimentary tract.
  - (a) In the lips and mouth and tongue—avoid rough pipe stems, jagged teeth; abolish pyorrhea.
  - (b) In the pharynx and larynx—eliminate chronic catarrh.
  - (c) In the esophagus—swallow no large boluses of food; eat slowly; masticate thoroughly.
  - (d) In the esophagus and stomach—avoid excess of strong irritant spices (for example, mustard, pepper) and avoid extremes of heat and cold, especially in drinks.
  - (e) In the stomach and duodenum—prevent duodenal distension, pyloric spasm, and duodenal and pyloric congestion, by abolishing the ileal stasis which causes them.
  - (f) In the small intestine—prevent bacterial decomposition of the contents of the jejunum and ileum due to ileal stasis.
  - (g) In the large intestine—prevent stagnation and decomposition of solid feces in any part; combat catarrh by local and general means.

It is never too early in life to commence these measures. In infancy, even on the first day of life, see to proper feeding. If artificial feeding is necessary the milk should be given at regular intervals in measured amounts at correct temperature; avoid overfilling the infant's stomach. Constipation in the infant is best combated by small doses of liquid paraffin.

In childhood, provision should be made for warm clothing, good regular meals, with vitamins in the diet, and an active day with midday rest, and a long, restful night. During school and college years the same conditions should be continued, with a regulated open-air life, avoiding extremes of exhausting effort, and insisting on an early hour for retiring and a minimum of eight hours in bed.

In patients who have not had the advantage of suitable conditions from infancy—that is, in whom stasis in a more or less severe degree is already present, the exact method to adopt must depend on the precise anatomical and pathological conditions which exist. If mechanical faults are present—for example, obstruction due to bands, or to cicatrices—these must be dealt with by surgical means. If the large intestine is already grievously damaged so that it is no longer capable of repair, nothing short of its removal will avail.

In less extreme cases much good may be done by careful attention to the details of hygienic living already described. In addition, mechanical means should be taken of supporting unduly dependent portions of the bowel, and liquid paraffin given to ensure two or three soft evacuations daily, vaccines to overcome the toxemia due to bacterial action in the large and small intestine, while medicines are useful to aid digestion, combat catarrh, and lessen spasm at the sphincters.

Cancer of the uterus and ovaries follows upon chronic inflammatory conditions of these organs. As already explained, stasis plays a very important role in bringing about these conditions of chronic inflammation. It is clear, therefore, that much can be done to prevent the occurrence of cancer in the pelvic organs by means which prevent or relieve chronic intestinal stasis.



**Exarticulation of the Hip Joint.** BARNEY BROOKS, St. Louis. *Journal of the American Medical Association*, January 9, 1921.

Brooks cites a case in which preliminary ligation of the common iliac artery was performed before the hip joint exarticulation was undertaken. There was little loss of blood. The patient's general condition was not disturbed by the operation, and the anemia of the tissue was not severe enough to influence the kindly healing of the operation wound.

**Operative Treatment of Old Hip Disease.** MARK H. ROGERS AND CHAS. W. PEABODY, Boston. *Journal of Orthopedic Surgery*, January, 1920.

The authors divide their cases into three groups in an endeavor to standardize a treatment to be used in each type.

The first group consists of those with practically ankylosis, fibrous or bony, but firm, with deformity of the hip joint, flexion and abduction, and shortening. The second group consists of those cases with deformity and with definite motion in the hip joint. The motion may be very slight, and may be difficult to obtain on account of muscular spasm but when these cases are under ether, there is always more motion than suspected. The third group consists of those cases in which the head of the femur is destroyed and the trochanter rides up on the acetabulum. This is the more rare condition and a difficult one with which to deal. There is practically always motion as well as deformity, and great disability on account of instability.

The first group, those cases with ankylosis and deformity, is treated with some form of osteotomy near the trochanter and outside the joint for the correction of the deformity.

In the second group, those cases that show deformity and motion, with a portion of the head left in the acetabulum, a Smith-Petersen incision is made from the anterior superior spine down the thigh. The space between the tensor vaginae femoris and the sartorius is located. This is the anterior approach to the hip joint. Then the incision is carried along the crest of the ilium for three inches and all the muscles are separated from the ilium subperiosteally. This brings one directly over the acetabulum and the head of the femur and allows a complete view of the hip joint. The hip joint is opened from the acetabulum down to the neck and the capsule pushed back from the head. Then enough of the head is removed to allow for the correction of the abduction and for the flexion deformity to be fully corrected. The acetabulum is cleaned out so that the head will fit securely into it and two bony surfaces are in apposition.

In the third group of cases the same incision is used. The top of the trochanter is placed into the acetabulum and the operator endeavors to make a stable joint. In the procedure the acetabulum is cleaned out and sufficient of the top of the trochanter cut off to get down to the bone. It is equally important not to remove too much of the trochanter on account of the necessity for a solid apposition.

In conclusion the authors state: The best result in such a destructive process as tuberculosis is firm ankylosis, and in order to prevent the recurrence of symptoms in adult life, this should be the aim of treatment.

The correction of deformity by means of osteotomy below the joint should not be done in cases where there is an unstable joint on account of recurrence of the deformity and on account of continued symptoms.

When there is motion in the joint, which is evidently the cause of symptoms, the deformity should be corrected within the hip joint and arthrodosis performed for stability of the joint.

**An Operation for Tuberculosis of the Wrist.** LEONARD W. ELY, San Francisco. *Journal of the American Medical Association*, December 18, 1920.

This operation necessitates cutting a groove in the radius and the third metacarpal and transplanting into it a graft from the tibia. The result is said to be a useful hand, possessing as much rotation as before the operation, and with excellent power in the fingers and thumb.

**Treatment of Fracture of the Femur.** KELLOGG SPEED, Chicago. *Archives of Surgery*, January, 1921.

The author quoting the results of various treatments from the study of cases reported by Nis, Martin, Estes

and the records of the Cook County Hospital, Chicago, together with his own experience, draws the following conclusions:

1. Because there is no accepted American standard of results after fracture of the femur, there is no American standard of treatment.

2. A large percentage of the fractured femurs are cared for by the first physician that sees them; specialists are not employed to direct treatment.

3. There is not sufficient effort put forth to use abduction or suspension traction methods, as obtained by the Hodgen or Thomas splint in fractures of the shaft, which may allow knee motion during the course of bone repair without disturbing the extension.

4. Portable roentgen-ray outfits should be furnished in all hospitals treating fractures of the femur, so that results in the course of treatment can be checked as frequently as desired.

5. There have been too many operations performed on fractured femurs by inexperienced operators, and without proper indication.

6. Very little attention is given to massage and electrical stimulation of muscles during bone repair and still less is given to after-treatment, so that many patients are permitted to bear weight on soft callus. Disability results. Walking calipers are little used.

The remedies suggested are:

(a) Every patient with fracture of the femur should be directed to a hospital for roentgen-ray examination, correct treatment by any of the accepted methods, and after-treatment when cured. This includes fitting the patient with a walking caliper as soon as he is ambulatory or on his discharge from the hospital.

(b) Because fracture tables offer good means of securing reduction and an easy method of external splinting by plaster of Paris, every hospital receiving cases of fracture of the femur should possess a fracture or orthopedic table. Careful records should be kept in accordance with fracture record sheet, such as has been compiled by the American Surgical Association, so that a large number of average results can be grouped, that treatment looking toward the ideal may be worked out.

**Precautions Necessary in the Selection of a Donor for Blood Transfusion.** LESTER J. UNGER, New York. *Journal of the American Medical Association*, January 1, 1921.

Unger considers it unsafe to perform a transfusion relying simply on the fact that donor and patient are of the same group. Preliminary to transfusion, the blood of every patient should be grouped and then tested directly against that of the prospective donor. All individuals may be divided broadly into four main groups. These groups are established by the presence of two "chief" agglutinins in the serums and receptors for these agglutinins in the cells. Besides "chief" agglutinins, "minor" agglutinins have been demonstrated. Ninety-seven per cent. of adults have agglutinins in their serum. They are, however, present in 3 per cent. of new-born infants. Only 25 per cent. of new-born infants have cells that can be agglutinated, as compared to 50 per cent. among adults. The full quota of agglutinins and receptors is required between the third and fourth years of life. Incompatibility between the blood of a mother and her new-born infant occasionally occurs. It is unsafe, therefore, to omit testing the blood preliminary to transfusion, even though the mother should act as donor. It is not advisable indiscriminately to use the so-called "universal donor," as severe reactions have been observed following the use of donors of Group IV for patients of other groups. The rouleaux-formation substance, even though acting on the donor's cells, is apparently harmless, and no untoward results have been seen following such transfusions.

**Treatment of Acute Tetanus.** Report of a Successful Case. ROBERT A. KILDUFFE AND W. B. McKENNA, Pittsburgh. *Journal of the American Medical Association*, January 1, 1921.

This report derives its interest from the successful result obtained in a well-marked and typical example of acute



tetanus in which the beginning of the treatment was delayed. The trauma was sustained September 9th. The wound received hospital treatment, but a prophylactic injection of tetanus antitoxin was not administered. Eight days after the original injury, the patient was conscious of pain in the jaws and arms, and some slight stiffness of the jaws, which became progressively worse. He consulted a physician and received some medicine which gave no relief. September 20th he came under the care of the authors. Immediately on admission, the patient was given 10,000 units of antitoxin—all that was on hand. A few hours later he became extremely rigid, the jaws tightly clenched, and a slight retraction of the neck was noticed, though typical bowing of the body as a whole did not occur. He complained bitterly of pain. The wound, after having been thoroughly cleansed and after drainage was established, was kept wet with a constant hydrogen peroxid drip. Anaerobic cultures gave a growth of typical tetanus bacilli of classic shape. Five hours after admission the patient received 20,000 units of antitoxin intravenously. He was also given 40 grains of chlorbutanol by rectal injection, every four hours for two days. The antitoxin treatment was entirely intravenous. A total of 140,000 units was given during six days of treatment. The patient was discharged October 11th, perfectly well, except for some muscular aching in the limbs comparable to that found after severe or unaccustomed muscular exercise, the abdominal muscles still being somewhat rigid.

**The Pathology of Gunshot Wounds of the Spinal Cord.** WILLIAM THORBURN, Manchester, England.  
*The British Journal of Surgery*, October, 1920.

The author, using the War Office Collection of injuries of the spine and spinal cord now lodged in the Royal College of Surgeons, and nearly one hundred wet specimens dissected, mounted, described and illustrated, classifies wounds of the spinal cord under obvious headings.

Considering the clinical aspects and post-mortem findings of 21 cases the writer lays down the following general propositions:

Gunshot injury of the spinal cord may be due to:

1. The direct impact of a missile, which may either penetrate it completely, or remain embedded in it, and which is liable to be accompanied by fragments of clothing, and especially of bone.

2. The indirect impact of fragments of bone, which again may penetrate completely, may remain embedded, or may recoil towards the positions from which they were dislodged, although such recoil is far less common and less obvious than in fractures of the vertebral bodies as seen in civil life.

3. Contusion by: (a) Foreign bodies which enter the spinal canal but do not penetrate the theca; (b) Displaced fragments of bone protruding slightly into the vertebral canal; (c) Displacement of the soft parts only, or, rarely, subluxation of the bones—the widely-spread divulsive or “explosive” action of a missile passing by at a high velocity.

In all cases the cord is liable to present mechanical destruction and hemorrhage extending widely beyond the area of apparent injury, and affecting especially the grey matter of the anterior cornua, where it produces long spindle-shaped areas of destruction. Such extension of hemorrhage is more widely spread where the missile is of higher velocity.

In the case of direct impact by foreign bodies, septic meningitis will generally ensue, but such meningitis is less common when impact is due only to fragments of displaced bone. It is generally absent in contusions of all forms, and the untorn dura matter is highly resistant to infections.

Meningitis tends strongly to extend upwards rather than downwards, and is usually continuous, but may spread unobtrusively along the membranes, to blaze up at remote points.

Hemorrhage sufficient to cause serious compression is very rare, but it is usually present in such quantities that, should life be prolonged, it may readily give rise to well-defined cicatrices, which will tend to assume the annular and constricting type often found at operation.

**The Influence of the Great War on Modern Surgery.**  
**Introductory Remarks at the Opening of the Surgical Section of the South African Medical Congress Held at Durban, October 4, 1920.** CHARLES F. M. SAINT, Capetown, S. A. *The Lancet*, December 4, 1920.

Summarizing his address the speaker draws the following conclusions relative to beneficial influences of the war on modern surgery:

1. The chief benefits arising from popularization of already existing procedures are blood transfusion, nitrous oxide-and-oxygen anesthesia, bone and nerve surgery, and orthopedic constructive work. Though bone surgery has been merely referred to, mention must be made of the Thomas splint, which achieved a well-earned and well-deserved popularity.

2. Among “rebirths” might be included a considerable portion of the present views of shock, the ligature of the bleeding point in arrest of hemorrhage, secondary suture of wounds, and excision of wounds and primary suture.

3. Finally, of “new discoveries and their applications” one has to refer to bipp, flavine, ambrine, and the calipers employed for extension in cases of fracture.

It will be readily seen that the chief benefits in civil practice attributable to war surgery are intimately associated with that branch of civil surgery which is comparable to that of war—viz., injury, in its various relationships.

**The Results of Wound Excision, with Suggestions as to Improvements and Alternative Methods.** MARTIN B. TINKER, Ithaca, N. Y. *The Military Surgeon*, December, 1920.

The method advocated by the author over ten years ago and used during the World War is described as follows:

“First. Pack the wound with tampons of sterile cotton or gauze saturated with sterilized oil.

“Second. Scrub the surrounding skin thoroughly and prepare as for aseptic operation. The oiled tampon and packing will prevent the bacteria which surely contaminate the scrub water, from penetrating into the wound.

“Third. After scrubbing thoroughly, and the use of anti-septic solutions for the surrounding skin, the oiled tampons should be removed. The oil can be removed by means of ether, gasoline or benzine swabs. The badly lacerated tissue should then be thoroughly swabbed with some powerful, certain germicide. It does not matter especially what germicide is used. Harrington’s solution, pure carbolic acid, strong solutions of formalin may be used. The wound should be thoroughly swabbed and an effort made to reach the bottom of every pocket and to work the disinfectant well into the ragged and bruised tissue. Only important structures, such as main vessels or nerves should be avoided.

“Fourth. With knife or scissors, excise tissues damaged by injury or the germicide solution. It is of advantage to use a tourniquet during incision of damaged tissue, otherwise free flow of blood is apt to obscure our field and prevent thorough work.

“Fifth. The wound can usually be closed safely as an ordinary clean incised wound without drainage; for if our work has been thorough we are dealing with healthy tissue of good vitality.”

Failure to obtain good results when possible to give the wound early and suitable attention are attributed by the writer to:

“First. Incomplete excision of damaged and infected tissues. This was evident from the presence of fragments of projectile of considerable size in the wounds, pieces of clothing or, most frequent of all, infection of bone which kept up prolonged suppuration.

“Second. Apparently unnecessarily extensive excision attended by loss of function.

“Third. The contamination of the clean cut areas of the wound during the excision from the infected material which was being removed.

“Fourth. Perhaps the most important cause of failure was imperfect knowledge of surgical anatomy. This led to the sacrifice of important blood supply, nerves and



tendons in some instances which seemed especially unfortunate."

To the general principles laid down above relative to wound excision the author recommends as adjuncts, staining of the tissues (the stain to be combined with a strong disinfectant), constructive plastic measures at the time excision is undertaken and the Carrel-Dakin method when feasible.

**Remarks on the Diagnosis of Acute Abdominal Diseases.** ARTHUR H. BURGESS, Manchester, England. *The British Medical Journal*, December 11, 1920.

In two lectures the author discusses the diagnosis of acute abdominal crisis.

The general symptoms include:

1. Various degrees of shock or collapse.
2. Alterations in the frequency and character of the pulse.
3. Changes in the temperature.
4. Alterations in the type of respiration—"thoracic" type.
5. Other symptoms, such as a dry and furred condition of the tongue, hiccough, strangury, and tenesmus.

After calling attention among the above signs to the fact that the temperature and pulse are most unreliable and often misleading the author groups the local symptoms as follows:

1. Abdominal pain.
2. Cutaneous hyperalgesia ("viscero-sensory" reflex).
3. Tenderness, local and general.
4. Nausea, vomiting.
5. Muscular rigidity ("viscero-motor" reflex).
6. Abdominal distension.
7. Presence of free gas in the peritoneal cavity.
8. Presence of free fluid in the peritoneal cavity.
9. Local abdominal or pelvic swelling.
10. Certain changes ascertainable upon rectal examination.

In conclusion, surgical technique has now reached such a high level of efficiency that further improvement therein cannot be relied upon to better the statistical results of the surgical treatment of acute abdominal crisis; such can be obtained only by earlier diagnosis on the part of the general practitioner permitting the application of surgical treatment at an earlier stage. The time that has elapsed between the onset of the attack and the opening of the abdomen is the real deciding factor in the ultimate issue of the case—far more so than the skill of the individual surgeon. Too much time must not be expended in making a diagnosis; one should be contented with recognizing that a grave lesion has occurred which is more likely to recover if surgically treated. The author speaking, he believes, for all surgeons, would rather meet in consultation the practitioner whose diagnosis, made in the early hours of the attack, is limited to "something gone seriously wrong in the belly," than he who, 48 hours later, can give a cut-and-dried and possibly perfectly correct description of what an operation will reveal.

**Solitary Amebic Abscess of the Liver.** Report of a Case Occurring Thirty Years After Residence in the Tropics.

WILLIAM J. MALLORY, Washington, D. C., *Journal of the American Medical Association*, December 25, 1920.

Mallory reports a case which occurred thirty years after residence in the tropics, thus making it evident that amebic abscess of the liver occasionally occurs a great many years after the primary and single attack of amebic dysentery. Therefore amebic abscess of the liver should be remembered as a cause of obscure fevers.

**Uterine Replacement by Extraperitoneal Round Ligament Fixation Combined With Intraabdominal Control.** L. DARTIGUES, *Presse Medicale*, November 10, 1920.

The author uses a technique, combining abdominal exposure with shortening of the round ligaments in the inguinal regions. The patient is put in Trendelenburg position and a low transverse incision is made, the ends of the incision extending into the inguinal regions so as to expose the inguinal canals. This incision extends to the aponeurosis, a longitudinal right rectus incision then being made through the parietes. The uterus and adnexa are thus exposed and any necessary treatment applied. The uterus is then returned to normal position. The inguinal canals are then opened in the extremities of the transverse incision and the round

ligaments are exposed. The peritoneal incision is now allowed to fall together partially and traction is made on the round ligaments. A large pack being put in the pouch of Douglas to keep the uterus up while this is being done. Fixation of the round ligaments is then made, anterior duplication being the selected procedure. The peritoneum is then closed. The inguinal canals sewed up in the usual manner and the skin then closed.

**Artificial Impregnation—Essays in Tubal Insemination.**

ROBERT L. DICKINSON, Brooklyn, New York City. *American Journal of Obstetrics and Gynecology*, December, 1920.

After discussing the preliminaries and technic of artificial impregnation the author directs attention to the following objections:

1. The possibility of infection of the tube and peritoneum.
2. Old tubal disease may be lighted up anew. It may, for a tubo-uterine orifice never closes. For the present at least such cases should be avoided.
3. It is possible that all that injection of semen accomplishes is to open the tube, in which case other fluids would do as well, and antiseptics be safer as used by Stone and Boece. Only tests can tell.
4. One can have no assurance that coitus subsequent to the treatment was not the real agent in procuring conception. This may be true and this is the reason that the veterinary surgeon can offer proofs which we cannot.
5. It fails with semen which is not vigorous. It was devised for just such cases and it has not helped so far.
6. The field is very limited because patients revolt at the idea, or give it one trial instead of half a dozen. They prefer laparotomy. All this is exact, but it does not relieve us of the responsibility of preventing the patient taking the greater risk should there be a simpler way, did we but have the will to face the distastefulness of working it out.

Dickinson summarizes as follows:—In women presenting histories or pelvic findings pointing to the sealed tube following milder types of salpingitis, entirely quiescent, infection into the uterine cavity of active semen produced no results in twelve instances. Strong pressure was not deemed warranted.

In women with no gonorrheal histories or findings, free from cervical inflammations and evident uterine, tubal or ovarian lesions or abnormalities, living semen of the poorer grades produced no results in nineteen patients. No infection followed except in one possible instance and that of mild type. Several of these received three trials.

With fairly normal pelvic organs and semen of good quality, five pregnancies followed and are believed to have been due to tubal insemination. The knee-chest posture, the curved pipette fitting the internal os and carried nearly to the fundus, injection into the tubes, horizontal rest, and repetition three to six times—these are considered important. Trial of this method may well precede resort to operation—save those done for external obstructions.

**Some General Considerations Regarding Prostatectomy.** J. T. GERAGHTY, Baltimore. *Southern Medical Journal*, January, 1921.

Indications for suprapubic prostatectomy:

1. When a suprapubic cystostomy has been recently performed for drainage, the enucleation usually should be carried out through the suprapubic opening.
2. A previous perineal operation, or the presence of dense scar about the bulbous or membranous urethra.
3. Multiple small calculi, especially when associated with diverticula.
4. Where prostatic hypertrophy is complicated with a lesion of the spinal cord the danger of incontinence following prostatectomy will be very considerably lessened by suprapubic removal.
5. Where there is present a very large intravesical hypertrophy with great dilatation of the internal sphincter, suprapubic prostatectomy will give better functional results. In this type of case, frequently following perineal prostatectomy, there is a slight weakness of the sphincters with consequent annoying dribbling, which may persist for some months. In the vast majority of these cases, however, the incontinence, which is only slight, disappears. Where no



special indications exist for the perineal operation the suprapubic should be the method of choice.

6. Where it is impossible, because of ankylosis of the spine and hip to put the patient in the proper perineal position.

#### Some Indications for Perineal Prostatectomy:

1. In every old and feeble man, peritoneal prostatectomy seems to be preferred. This operation is attended with considerably less shock than the suprapubic operation which inherently causes greater disturbances than the perineal.

2. Small fibrous prostates should be removed perineally, as successful removal through the suprapubic route may be very difficult or almost impossible.

3. Patients with a great deal of abdominal fat should have the perineal operation rather than the suprapubic, because the fat does not resist infection well, and convalescence consequently may be protracted.

4. Where there is present a very large inguinal hernia the perineal operation seems definitely indicated.

5. Where there is present a localized area suspicious of carcinoma, better exposure of the involved part will be secured through the perineum, because cancer of the prostate nearly always occurs in the posterior lobe. In occasional cases it will be possible to excise completely the carcinoma without a complete radical operation. It is impossible, by the suprapubic route, to remove carcinoma involving the posterior lobe.

6. Repeated previous suprapubic operations are an indication for the opposite route.

#### End-Result of Tonsillectomy. JOHN A. VIETOR, New York. *Archives of Pediatrics*, December, 1920.

The author in this article gives a statistical report of 500 consecutive cases of tonsils and adenoids operated upon and their end-results—arrived at through a "follow-up Clinic" and an endeavor to see the cases at intervals for one post-operative year. Seventy-nine per cent. of the cases were actually followed for 5 1-2 months; 4.21 per cent. of the cases were lost track of.

The operation itself was performed in the operating room under a general anesthetic (nitrous oxide gas and ether) with the exception of only two cases, when a local anesthetic was used and the operation was performed by Dr. James P. Erskine, the consulting laryngologist. No operations were done in the out-patient department, as that procedure is considered unsafe and dangerous on account of subsequent bleeding and danger of infection in an open throat.

Technique. Since the fall of 1915 the tonsils have been enucleated by dissection with instruments instead of by the finger. The Rose position, combined with the Hitz mouth gag and the Pool and Kenyon aspirator, with a specially designed suction tip, is used in order to get the best exposure and protect the patient from aspiration of blood, mucus and pus. The tonsils are removed by the snare, and adenoids by the curette, followed by finger palpation to insure a perfectly clean nasopharynx. After operation, patients are put to bed and kept quiet, special observation being kept for any undue hemorrhage. If one day after operation the temperature is normal, patients are allowed up on doctor's order. Children are usually kept in bed a day longer than adults, and no throat irrigations or applications are employed on either as routine.

The author draws the following conclusions:

1. Tonsillectomy and adenoidectomy in well chosen cases, performed by general surgeons, in a general service, under proper conditions, show 97 per cent. symptomatically good results.

2. The complications arising either early or late are few and not severe in character.

3. The benefits arising both in simple cases and those in which tonsils act as a portal of entry, warrant their removal.

4. The dangers of the operation are almost nil, as shown by the fact that there were no deaths due directly or indirectly to the operation in this series of 500 consecutive cases.

#### Rhabdomyoma of the Nose. Report of a Case. GEORGE S. REITTER, Indianapolis. *Journal of the American Medical Association*, January 1, 1921.

Reitter reports an experience with a case which led him to believe that rhabdomyomas that have an abundance of the

connective tissue elements will show partial, if not complete, retrogression when treated with heavy doses of radium. His patient was a girl, aged 14. As the father refused to consider any surgical procedure, an attempt was made to reduce the tumor with radium. Only the gamma rays were used. Three hundred milligrams of radium element, screened with 3 mm. of lead and 2 mm. of rubber, at a distance of 2 cm., a total of 6,500 milligram-hours, were applied to four areas, which completely covered the surface of the tumor. Microscopically, no change in the tumor was noted, except for a slight transitory erythema that lasted for three days. About three weeks later the tumor showed a reduction of about an inch in the outside circumference.

#### Acute Mastoiditis—Indications for Operation. GEORGE MORRISON COATES, Philadelphia. *The Therapeutic Gazette*, November 15, 1920.

The author discusses each of the usual points of diagnosis and comments on their relative value.

In typical case one expects to find:

1. More often a child than an adult.
2. A history of predisposing cause (cold, measles, scarlet fever, bathing).
3. A history of pain, ear-ache, and aural discharge of greater or less duration.
4. Redness, edema or fluctuation over mastoid process obliterating, the temporo-auricular crease.
5. An auricle protruding, wing-like, from the head.
6. Tenderness over the entire mastoid process, or over certain points—e. g., the antrum, the mastoid emissary vein, or the tip.
7. Sagging of the postero-superior wall of the external auditory canal.
8. The membrana tympani red, bulging, or perforated.
9. Discharge of pus through the perforation, or if unperforated, pus in the middle-ear cavity.
10. Impaired hearing of greater or less degree.
11. Tuning-fork tests suggestive of conductive deafness.
12. Fever of moderate degree, 100 to 102°, without marked fluctuation.
13. Pulse commensurate with the fever.
14. Negative eye grounds.
15. Organism isolated from aural discharge, usually streptococcus viridans or hemolyticus, or pneumococcus.
16. White blood count increased to 12,000 or 15,000.
17. X-ray showing a cloudy mastoid indicating fluid or destruction of cell walls.
18. Any evidence of intracranial complication.

After reviewing each of the diagnostic points the author concludes that up to the present time there is no single diagnostic factor which is a positive indication for operation—and that such surgical procedure can be undertaken only when a combination of positive points is present.

#### The Gangrenous Processes in Ludwig's Angina. (Les processus gangreneux, dans l'angine de Ludwig)—E. L. REYRE, *Press Medicale*, November 3, 1920.

The author prefers to consider Ludwig's angina as a gangrene, analogous to the gangrene seen in the war, rather than a phlegmon. It is provoked in reality by anaerobic bacteria, causing a local gangrene and often complicated by a fatal toxemia. Local inflammatory changes may also be present. The generalized toxemia may be very severe and out of proportion to the local condition, as it frequently is in any gangrenous process.

As rapid an intervention as is possible is desirable to reduce the gravity of the infection. A horizontal submaxillary or a median vertical incision may be used; two parallel paramedian vertical incisions are also used. One must not wait for the appearance of evident symptoms. Late incisions are only effectual in median subhyoid local phlegmons, not in true Ludwig's angina. General anesthesia is inadvisable because of the very marked and rapid reaction the patient has to any of them. Very little pain is felt because of the marked toxemia, therefore no anesthesia is advisable if combined with a short operation. The mylohyoid should be divided in the median line. Digital cleansing is better than ordinary tube drainage; Dakin's solution is also very good, giving both mechanical washing and bactericidal effect in the after-treatment.



**Pleural Empyema with Diphtheria Bacilli.** WALDEMAR GOLDSMITH. *Wiener Klinische Wochenschrift*, September, 16, 1920.

Diphtheria bacilli cling generally to the diphtheric membrane, and very seldom spread beyond it.

The author describes a case in which in the pus of empyema—(preceded by a probable diphtheric affection of the nose) diphtheria bacilli were found.

A three year old girl was brought to the Clinic of Surgery of Prof. Eiselsberg, from the Clinic of Pediatrics on the 23rd of April, 1920, with the diagnosis: Mongoloid, Pneumonia, Empyema lateralis sinistra. In the previous history is mentioned a purulent thick discharge from the nose, the bacteriologic examination of which gave a negative result to diphtheria; however, 2000 A. E. serum was injected on the 9th of April. On the 14th of April pneumonia set in on the left side; and on the 20th, pleuritis. On the 23rd, exploration discovered abundant, thin pus.

April 23rd, temperature, 37.5° c.; pulse, 140. Puncture with trocar drainage. After 36 hours patient died.

**Deductions:**—Suppurating lobar pneumonia; empyema thoracis. In the pus of the empyema streptococci and diphtheria bacilli; in culture: diphtheria bacilli.

## Book Reviews

### The Difficulties and Emergencies of Obstetric Practice.

COMYNS BERKLEY, M.A., M.D., M.C., CANTAB, F.R.C.P., LOND., M.R.C.S., ENG. Obstetric and Gynecological Surgeon to the Middlesex Hospital; Surgeon to In-patients, Chelsea Hospital for Women; Senior Obstetric Surgeon, City of London Lying-In-Hospital; Gynecological Surgeon, Eltham and Mottingham Hospital, etc., etc., and VICTOR BONNEY, M.S., M.D., B. Sc. LOND., F.R.C.S., ENG., M.R.C.P., LOND.; Assistant Obstetric and Gynecological Surgeon to the Middlesex Hospital; Lecturer on Practical Obstetrics, Middlesex Hospital Medical School; etc., etc. *Third Edition*. Royal Octavo; 781 pages; 309 illustrations. Philadelphia. P. BLAKISTON'S SON & Co., 1921.

This attractive book concerns itself in no wise with normal pregnancy or uncomplicated delivery. It is, however, an admirably comprehensive work on all the complications, difficulties and emergencies that may arise in pregnancy, labor or in the newborn infant. It seems to us to be a very complete reference work and guide in the recognition and treatment of these difficulties and complications, unusual as well as common,—nutritional, medical, mental, surgical, dermatological and obstetrical. It is not merely a scientific array of, or discourse upon, such complications, but a textbook that deals with them in a very practical fashion, and made the more useful by a wealth of excellent original illustrations. The descriptive matter is terse and clear, the directions practical and sensible.

About 200 pages are devoted to various complications of pregnancy and to a chapter on "difficulties in the diagnosis of pregnancy". The next 500 pages deal with hemorrhage at various stages, with abnormalities, complications and accidents of labor and the puerperium, and with concise descriptions of obstetric operations. A chapter of about 40 pages deals with diseases, injuries and deformities of the new-born. Concerning depression of the cranial bones, the authors state that if this does not disappear and cannot be corrected by manual pressure "it should be rectified by an operation", but they fail to say that the simplest operation is to lift up the depressed bone with a sharp hook (tenaculum). Concerning the surgical treatment of congenital hypertrophic stenosis of the pylorus they say only that "the operation most commonly performed is dilatation of the pylorus through an opening in the stomach". Ramstedt's operation is thus not referred to.

In this edition, the result of considerable revision, there has been added a final chapter on "the feeding of infants", written by H. C. Cameron

**Surgical Pathology and Morbid Anatomy.** By SIR ANTHONY A. BOWLBY, K.C.B., K.C.M.G., K.C.V.O., F.R.C.S., Surgeon in Ordinary to His Majesty the King, and Consulting Surgeon to St. Bartholomew's Hospital; President Royal College of Surgeons of England; and SIR FREDERICK W. ANDREWES, M.D., F.R.S., Lecturer on Pathology in the University of London. *Seventh Edition*. Large Octavo: 636 pages; 210 illustrations. Philadelphia: P. BLAKISTON'S SON & Co., 1920.

It is thirty-three years since Sir Anthony Bowlby's "Surgical Pathology" first appeared. In its successive editions, and especially in this one, that small work has been increased in size, not merely by the growth of the text but also by the enlargement of the format. In this issue it is still, however, a book of very convenient size to handle. Correspondingly, it is not, it seems to us, a comprehensive exposition of surgical pathology, although it covers a wide range of surgical diseases.

Three new sections appear in this edition, dealing, respectively, with *gas gangrene*, *shock* and *tetanus*; the old illustrations have been redrawn larger; and the text has been submitted to general revision. We have been interested to note that in this revision a scientific inaccuracy in the earlier editions has not been corrected. As before, the statement is made concerning bone abscesses: "Chronic abscess is never met with in the shafts, but always in the cancellous tissue of the epiphysal ends". Chronic bone abscesses, sometimes sterile, are met with in the shafts, usually in the medulla as a residuum of a pyogenic coccal (osteomyelitis) or typhoid infection, or, sometimes in the cortex (e. g., typhoid abscess). Admitting this correction, there ought then also be revised the succeeding statement: "It is probable that almost all of these abscesses are of tuberculous origin..." (page 308).

**The Anatomy of the Human Skeleton.** By J. ERNEST FRAZER, F.R.C.S., Eng., Professor of Anatomy in the University of London and Lecturer in the Medical School of St. Mary's Hospital; Examiner in Anatomy for the University of London; Examiner in Anatomy for the Primary Fellowship of the Royal College of Surgeons of England; Formerly Examiner in Anatomy for the Conjoint Board of the Royal Colleges of Physicians and Surgeons. *Second Edition*. Quarto: 284 pages; 219 illustrations, many in colors. Philadelphia: P. BLAKISTON'S SON & Co., 1920.

The thoughtful student of anatomy will find much interesting information in reading this work as supplemental to his "Gray" or "Piersol" and to his tissue studies. In this edition several new illustrations appear.

**French-English Medical Dictionary.** By ALFRED GORDON, A.M., M.D., (PARIS). Late Associate in Nervous and Mental Diseases, Jefferson Medical College; Late Examiner of the Insane, Philadelphia General Hospital; Neurologist to Mount Sinai, to Northwestern General and to the Douglass Memorial Hospitals; Fellow of the American College of Physicians, etc., etc. Octavo; 161 pages. Philadelphia: P. BLAKISTON'S SON & Co., 1921.

The title of this book fairly indicates its contents. It gives the pronunciation and the English equivalent of French terms used in medicine.

France has contributed her full share to medical science. She is continuing this contribution, and in the current literature are many important articles, monographic treatises that have come, among other sources, from war-stimulated French studies in bacteriology, neurology, medicine, surgery. To those who would read these publications in the original—and scientific French is not at all difficult to understand—this dictionary ought to be very welcome. Dr. Gordon has done a useful thing in preparing it.

**Eating to Live Long.** By WILLIAM HENRY PORTER, M.D., With an Introduction by EDWIN F. BOWERS, M.D. Duodecimo; 243 pages. Chicago: The Reilly & Lee Co., 1920.

Other things being equal, recovery and euphoria are not only dependent on a proper dietary before and after operation but are conditioned to a large degree in most cases by the ordinary habits of eating. The far-reaching importance of this statement can be visualized by the fact that



the surgeon is becoming more and more active in fields which were until lately regarded as exclusively the province of the internist. Therefore no surgeon can afford to ignore dietetics, but when beginning the study of this science in the light of recorded opinions he finds himself sorely perplexed by the contradictions of writers. Porter's book, bearing the endorsement on the coverslip of seven members of the profession prominent in medicine and surgery, informs the reader at once of this discrepancy in the following words: "What is more surprising, however, is that medical men, among them men who have won an enviable reputation as physiologists and clinicians, are almost equally at sea respecting the uses and proper selection of food. So conflicting has been their experience, so confusing their findings, that hardly any two modern authorities agree upon even the fundamentals of nutrition." Porter emphatically declares himself against the vegetarians because of the polymerism of the vegetable proteid molecule, which has to be changed into an isomeric form before it can be acted upon, whereas he believes the proteid molecule of animal derivation to be more readily digested, absorbed and assimilated because of its monomeric structure; and that vegetable foods "are much more prone to excite putrefactive fermentation in the alimentary canal" by reason of the exhaustion of available oxygen during transformation of the larger amount of carbohydrates present. Over against this Kellogg, the protagonist of the vegetarian system, in a recent paper covering thirty years experience in Battle Creek, quotes Tissot that vegetable proteins are only about half as prone to putrefy as animal proteins and claims that Torrey has recently demonstrated the same fact; also approving Paget's claim that the higher death rate from operations on persons dwelling in cities, compared with rural districts, as due to the larger ingestion of meat among urbanites. In chapter XI the lactovegetarians are given another jolt. The author is convinced that the eating of fruit especially in conjunction with meals is one of the most pernicious and reprehensible of dietetic follies. He believes that the extra acidity of the material makes it difficult for the alkaline juices of the intestine to neutralize the food pabulum with the consequence that the heat and moisture unite with the fermentative processes to break down the substances, thus favoring decomposition of the albuminous compounds and the development of the alkaloids of putrefaction; and that ailments such as headaches, neuralgia, neuritis, rheumatism, sciatica, lumbago, skin eruptions, even diabetes and Bright's disease have their origin "in nothing more or less complex than the injudicious use of fruit and fruit acids." The laxative action of fruit is regarded as due to abnormal fermentation of food stuffs in the alimentary canal. Apparently the author is unaware of the careful and thoroughly scientific work of Schmidt and Strasburger on the hormone-producing flora of the intestines in the matter of curing constipation; indeed, the reader is apprised that a liberal animal protein diet will overcome chronic constipation.

Why are equally earnest and successful practitioners so much at variance with one another on such an intensely practical matter? Most likely because we know so very little about the digestive functions dietetics is as yet much more of an art than a science and, secondly, because recovery is too readily assumed to be the result of a particular diet. It has been said that a normal life begins and ends on milk. Give a nursing cow's milk and as like as not it will keep the family awake all night but who ever heard an octogenarian bawl after partaking of it? Everytime Jones eats corned beef and cabbage in his own home he gets sallow and morose but if he eats it across the street, at his friend Smith's, he goes about his office the next day declaring this world to be a good place to live in. The caloric fetish, by its purely chemical viewpoint, is responsible for the lack of progress in dietetic science; it is roughly and rightly handled by the author. Those accustomed to careful objective study of the alimentary secretions are aware of the incessant variations in amount and quality even in apparently healthy persons and know that therefore other factors besides mere chemical interaction are at work which must be taken into account. The first is the important one

of the varying bacteriolytic power of the upper half of the alimentary system. The second is the biologic fitness of the diet, which however, must include far more than the accessory food substance. Thirdly, is the difficult factor of reasonably gauging the degree of comminution, consistence and total bulk in accordance with the dynamic amplitude of the gastric muscle. Fourthly, pathological reactions after ingestion. Fifth, conditions in the colon. The reviewer's experience is similar to that of Bassler, that dietetic measures alone do not result in permanent removal of the intestinal toxemias. Sixth, the psychic environment during ingestion, considered in its widest sense; Pavlov's work has by no means exhausted the subject. So little is known concerning these factors that it can be seen why there is so much divergence in the writings and that dietetic science is only in the making. Sweets are curtly labeled by the author as life-shorteners, which is certainly true in many instances. On the other hand, the propaganda against sugar should not be pushed too far. The industrial worker of the ptotic type does not thrive well when cut off from sugar. A moderate pre-operative alimentary hyperglycemia appears to minimize the shock and to prevent the acidosis accompanying surgical procedures. Chapter XXI deserves to be read by every practitioner because the alcohol question is discussed in the light of experience and in a thoroughly scientific manner. Since the late emergency there is a noticeable tendency of a too free recourse to the "blessed morphin" in casualty practice. Of course when shock is being maintained by pain it is the only logical remedy. Its ultimately deteriorating action in the psychic spheres is noticeable in proportion as the pain element was in abeyance. But it is just in these cases that the primary stimulation of alcohol followed by the block action on the nerve endings, including the nerves of muscular sense, its action on the peripheral vasomotor nerves and mild central anesthesia, commend it to the prudent practitioner. The word prudent is used advisedly because alcohol has been abused in medicine and surgery by overdosage.

Since the science of dietetics is only in its infancy owing to the complexity of the factors involved, the practitioner must still hold fast to the formula of the ancients, that the methodic of adequate nutrition is an individual problem which can be evidenced only by vital and social efficiency and the joy of living. A book such as the one under review is helpful, it should be read, re-read and pondered, not indeed as a definitive treatise, but as the testimony of an experienced clinician.

A. V. WENDEL.

**Orthopedics for Practitioners.** An Introduction to the Practical Treatment of the Commoner Deformities. By PAUL BERNARD ROTH, M.B., Ch.B. (Aberd.). F.R.C.S. (Eng.). Senior Surgeon, and with Charge of Orthopedic Cases, Kensington General Hospital; Member of Orthopedic Section, Royal Society of Medicine; Late Surgeon, City of London Military Hospital; Senior Orthopedic Clinical Assistant, London Hospital, etc. Small octavo; 190 pages; 57 illustrations. London: EDWARD ARNOLD, 1020. New York: LONGMANS, GREEN, & Co.

In this work the author has condensed a great deal of practical information in small compass. It deals with the skeletal deformities that come under orthopedic treatment, tuberculosis of the spine and the joints, amputation stumps, and some of the affections of the hands and feet. There are chapters also discussing briefly the general principles of treatment in fractures, dislocations and other joint injuries, peripheral nerve injuries and old gunshot injuries. The author uses plaster of Paris very little, but describes the employment of various splints, especially Thomas'. In the treatment of fractures he enthusiastically supports the method of Lucas-Championnière; and he urges exact reposition, recommending open operation to accomplish this when necessary. He condemns "rapid correction" efforts (Abbot) in spinal curvature.

While the information contained in this book will be found in larger works on orthopedic and general surgery, it is presented here in the form of a convenient manual that ought to be useful to the novitiate in this specialty. It is a practical introduction to the subject—fundamental rather than merely elementary.



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## PULMONARY SUPPURATION—ITS DIRECT TREATMENT THROUGH THE BRONCHOSCOPE

A report of the work on pulmonary suppuration in the Laryngological Service, Mt. Sinai Hospital, New York City.

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OMAHA, NEB.

The term pulmonary suppuration is here used to include lung abscess, bronchiectasis, pulmonary gangrene, and suppuration in association with neoplasms and with foreign bodies. The history of the treatment of pulmonary suppuration, with the outstanding exception of that due to the inhalation of foreign bodies, is a disappointing one. The frequent reports of lung abscesses in recent years, following both pneumonia and tonsillectomies under general anesthesia, have brought this question sharply to our attention and have served to emphasize the need for improvement in our method of treatment.

Medical treatment has been of little or no avail. At best it has been only symptomatic and chiefly expectant in character. Artificial pneumothorax has been tried as in tuberculosis and isolated successes have been reported, notably by Tewksbury.<sup>1</sup> Analysis of these reports shows that most of the favorable results were in acute lung abscesses of less than six weeks' duration. Acute lung abscesses exhibit a definite tendency toward spontaneous recovery. Wessler<sup>2</sup> reports that 33% of all cases of pulmonary suppuration recover spontaneously within two months. This fact must be borne in mind in considering the results of any form of treatment, whether pneumothorax, vaccine, or bronchoscopic. Our experience with pneumothorax is limited to observation in three cases. In each of these there was an immediate extension of the suppurative process, the collapse of the lung causing a dissemination of the infective material.

As early as 1904, attempts were made to treat pulmonary suppuration by the direct introduction of medication into the bronchial tree. In that year Jacob, Bougert, and Rosenberg<sup>3</sup> published their work, in which a catheter was introduced into the trachea and various solutions injected through it. In 1910, Ephraim and in 1912, Guisez<sup>4</sup> made similar attempts by introducing a spray into the subglottic region, under guidance of the laryngeal mirror, and injecting medication into the trachea. It is obvious that the

solutions injected failed to reach the areas for which they were intended.

The rapid development of thoracic surgery in the past decade has offered a glimmer of hope to a few of these patients. To Sauerbruch, Lilienthal, Lenhartz, Robinson, and Meyer, credit is due for their brilliant work in this difficult phase of surgery and for some noteworthy operative results. The surgical indications are extremely strict, however, and the percentage of cases favorable for surgical intervention is very small. The operative mortality is high, various operators reporting from 35 to 70 per cent.

The fact remains that notwithstanding the various attempts at treatment, the large mass of patients with pulmonary suppuration have remained untreated and have lived the lives of social outcasts, their profuse and fetid expectoration as repulsive to themselves as to their friends and families. It is in the hope of calling attention to the possibilities in the direct treatment of pulmonary suppuration through the bronchoscope as suggested by Yankauer in 1916,<sup>5</sup> that this communication is presented. The cases cited are from the Laryngological Service of Mt. Sinai Hospital and from the private practice of Dr. Yankauer, and were treated either by him or under his supervision.

## PULMONARY SUPPURATION WITH BRONCHIECTASIS AND GANGRENE

Pulmonary suppuration except in the very acute stage is always associated with some degree of bronchiectasis and gangrene. In addition, some of the cases are complicated by constriction of the lumen of the bronchus leading to the focus. This type of case will be discussed later. The bronchiectasis is especially marked in the more chronic cases. The pathology in this type of case emphasizes the difficulties with which the treatment must cope. There is present an extensive peribronchial fibrosis surrounding non-collapsing, suppurating, and gangrenous bronchiectatic cavities, from which frequently all vestiges of normal mucous membrane have disappeared. The process may be limited to one lobe or it may involve any number or all of them. Both lungs may be literally riddled with bronchiectatic cavities. As the spread of the disease is due to the infection of new areas by the inhalation of pus from infected areas, the lobes in-



volved are usually contiguous. This is not always true, however.

In this connection, it must be mentioned that the bronchoscope is the most exact means at our disposal for the localization of the suppurative foci. At times owing to the overlapping of the various lobes, it is even more reliable than the Roentgen findings. It has often been the deciding factor for or against surgical intervention. Eighty-two cases of pulmonary suppuration, exclusive of suppuration in association with foreign bodies and neoplasms, have been bronchoscoped for diagnosis or treatment. The following table shows the frequency with which the various lobes were found to be involved:

Bilateral, all lobes involved .....	6
Right lung, all lobes involved .....	12
Left lung, all lobes involved .....	7
Right upper lobe .....	13
Right middle lobe .....	5
Right lower lobe .....	20
Left upper lobe .....	7
Left lower lobe .....	8
Right middle and right lower lobes .....	2
Right middle and right upper lobes .....	1
Right upper and right lower lobes .....	1

The treatment consists in the regular irrigation with aspiration, at intervals, of the suppurative cavities. The bronchoscope is introduced into the focus or into the lumen of the bronchus leading to it, and by means of the double current canula devised by Yankauer, the irrigating fluid is injected into the suppurating area and the solution is withdrawn by aspiration. Continuous irrigation and aspiration are maintained until the solution returns clear. If more than one lobe is involved, the process is repeated in each involved lobe. Four to twelve ounces of solution are used with each irrigation. The irrigating fluid may be normal saline solution or one containing an antiseptic. After experimenting with various solutions we have found that clinically a weak iodine solution yields the most satisfactory results. Irrigations are commenced with a 1-1000 solution. The concentration is increased at intervals to that of a 1-400 solution.

The interval between the bronchoscopic irrigations varies with the condition of the patient and the response to treatment. If the expectoration is profuse and very fetid, the bronchial irrigations are given weekly. The interval is soon increased, however, as the expectoration and the cough diminish. At present some of our patients report for treatment monthly, some once every two, three or four months.

#### PULMONARY SUPPURATION WITH CONSTRICTION OF THE LUMEN OF THE DRAINING BRONCHUS.

This condition was present in ten cases in this series and caused definite interference with drainage in each. The bronchial constrictions can be diagnosed only with the bronchoscope and can be treated when present in the primary and secondary and occasionally tertiary divisions of the bronchi. The condition may be due to

1. *Inflammatory swelling of the bronchial mucosa.* This condition is frequently seen in acute pulmonary suppuration and in the acute exacerbations of chronic cases. We have seen a similar condition in a case of delayed resolution in lobar pneumonia. By treatment we have succeeded in aborting acute exacerbations. The treatment consists in shrinking the mucous membrane with cocaine and adrenalin and the application of a weak solution of silver nitrate or argyrol. This is followed by irrigation of the bronchus beyond the constriction. Case 3.

2. *Exuberant granulation tissue.* This may be found deep within the lumen of the involved bronchus but is more frequently present at its orifice. The main lobe bronchi are commonly involved and may contain sufficient granulation tissue to obstruct the drainage. In three of our recent cases, the right upper lobe bronchus was so completely occluded as to prevent the entrance of the bronchoscope into that lobe. The granulation tissue is cocainized, dried and cauterized with strong silver nitrate solutions. The bronchus is then irrigated beyond the constriction. Case 4.

3. *Cicatricial contraction.* This follows extensive ulceration of the bronchial mucosa and is commonly observed at the orifice of one of the lobe branches. It may also be due to syphilitic cicatrices of the bronchi, though we have not as yet observed this condition in the bronchoscope. We have seen and treated luetic strictures of the trachea but they were not associated with suppuration. Cicatricial contraction is treated by dilating the stricture with bronchial dilators and irrigating the pus focus beyond it. Case 5.

4. *Neoplasms.* These usually cause bronchial constrictions, but constitute a distinct phase in pulmonary suppuration and will be considered later.

5. *Post-Diphtheritic Stenoses.* Lynah and others have reported pulmonary suppuration in association with post-diphtheritic bronchial stenosis. We have had no experience with this type of case. Bronchial dilatation and irrigations are indicated.

6. *Other causes.* Narrowing of the lumen of a bronchus by extrabronchial conditions such as mediastinal growths, mediastinal cysts, interlobar empye-



mata, closed abscess cavities and aneurysmal dilations is not within the scope of bronchoscopic treatment. The bronchoscope, however, has at times proved an invaluable aid in their diagnosis. We have seen pulmonary suppuration in association with each of these conditions.

#### RESULTS.

Therapeutic innovations in the field of medicine must inevitably contend with the skepticism of the medical profession and properly so. The bronchoscopic treatment of pulmonary suppuration has been no exception. As a consequence, we have had referred to us for treatment chiefly those cases of the more advanced and chronic type. The pathology would seem to preclude the possibility of permanent benefit from any type of treatment. Nevertheless, our results have been very encouraging. The first effect of the treatment is the complete cessation of the fetor oris. Coincident with this is a rapid diminution in the amount of expectoration and cough. Immediately following each bronchoscopic treatment, the cough and expectoration are at a minimum and not infrequently disappear for several days. There is an improvement in the physical signs as evidenced by an improved resonance, clearer breath sounds and change in the character and number of rales. Cavernous signs are frequently present after bronchoscopy when previously absent. It is of interest to note that following a bronchial irrigation, there is frequently a complete absence of rales, giving evidence of the thoroughness of the irrigation and of the completeness of the removal of the irrigating fluid by aspiration.

We have treated 29 cases of chronic pulmonary suppuration with repeated bronchoscopic irrigations and applications. Four of these patients have been cured, having received 102, 75, 40 and 14 bronchoscopic treatments respectively. They present no subjective or objective symptoms after an interval of one and a half years. Nineteen of the patients have been so improved as to the amount and character of expectoration and cough that they have been able to resume their respective occupations. Three cases failed to respond to treatment except for the cessation of odor. Three cases have died, one from a cerebral abscess, and two from extensive bilateral bronchiectases. In the series of 29 cases, 23, including the four cures, or 79%, have not only been kept alive, but the complete cessation of odor, the diminution in the expectoration and cough, and the improvement in the general condition has been such that these patients have been given a new lease on life. They have been able to take their place in society, continue with their work

and resume a productive life. The change in mental attitude has been a notable factor.

Bronchoscopy with bronchial irrigation is not as trying a procedure as is generally believed. The patients report to the hospital, are bronchoscoped and treated, and return to their homes the same day. All are able to resume their occupations the morning following the treatment. To date we have given 1,054 bronchoscopic treatments with no un-toward results. We have had no single instance of pneumonia nor extension of the process following a treatment. Though some of our patients have been bronchoscoped over 150 times, with the exception of a slight hoarseness following the first or second bronchoscopy, there has been in no case a disturbance in the function of the vocal cords.

The following cases demonstrate some of the various phases of pulmonary suppuration encountered and the treatment of each.

CASE I. H. K., male, age 26, was admitted to the Laryngological Service Mt. Sinai Hospital, March 9, 1917, with a history of cough and expectoration for 15 years. He has had two attacks of pneumonia, at 2 and 10 years of age respectively. For the past 15 years he has had a cough with profuse expectoration, especially aggravated by change in position. The condition has been much more pronounced during the past year. The expectoration is fetid and averages 500 cc. daily.

Physical Examination—Fetor oris. Dullness left lung, from apex to base, with harsh bronchovesicular breathing and numerous crepitant and subcrepitant rales. Diminished breathing, crepitant rales at right base. Clubbing of fingers.

Complement fixation tests for syphilis and tuberculosis are negative. Sputum repeatedly negative for tubercle bacilli. Blood and urine negative.

Roentgen findings—Left lung occupied by dense irregular shadows containing many lighter areas, probably cavities. Recent infiltration, right base.

Bronchoscopic findings—Marked bronchiectasis left bronchus, extending into its primary and secondary divisions. Pus exuding from all visible branches in both lobes. Moderate bronchiectasis right lung.\*

The patient was treated with bronchoscopic irrigations, given weekly at first but with gradually increasing intervals. There was a progressive improvement in the cough and the amount of expectoration, with a complete cessation of both after 1½ years of treatment. In all, the patient received 95 bronchoscopic irrigations. He has been free from symptoms since October 1, 1918.

CASE II. N. R., age 32, was admitted to the Medical Service, Dr. Manges, Mt. Sinai Hospital, November 24, 1916, with a history of cough and purulent expectoration for 15 months. The past history is negative. The cough and expectoration had their onset 10 days following a tonsillectomy under general anesthesia and have grown progressively worse. Has oc-



casional free intervals of a week. The sputum is fetid, occasionally blood-tinged, and averages 200-300 cc. daily.

Physical examination—Thyroid gland enlarged. Signs of infiltration of right lung from apex to third interspace. Fingers clubbed. Enlargement of anterior and posterior cervical and inguinal glands.

Blood Wassermann and tuberculosis fixation tests negative. Sputum negative for tubercle bacilli. Blood and urine negative.

Roentgen examination—Dense infiltration, paravertebral portion of right upper lobe. There is also an infiltration extending along first interspace as far as axilla. No definite evidence of cavity.

Bronchoscopic examination—Right upper lobe bronchus filled with secretion and lumen dilated. Middle and lower lobe bronchi dilated but contain no pus.

The limited involvement and excellent general condition were favorable indications for surgical intervention and on December 11, 1917, Dr. Lilienthal performed a first stage operation in which he compressed the lung with packing. The patient refused the more radical secondary operation and was transferred to the Laryngological Service for bronchoscopic treatment. The treatment consisted in irrigation of the right upper lobe.

The improvement in this patient was particularly rapid. After receiving 14 treatments there was a complete subsidence of cough and expectoration. The patient has been free from symptoms for over two years.

CASE III. F. M., male, age 32, complains of cough and expectoration  $3\frac{1}{2}$  months' duration. The past history is negative. The present illness had its onset  $3\frac{1}{2}$  months ago, following a tonsillectomy under general anesthesia. One week following the operation, the patient began to cough. Cough accompanied with expectoration. Expectoration rapidly became profuse and fetid. Sputum at present averages 450 cc. daily.

Physical examination reveals an infiltration in right lung from apex to 4th interspace. Examination is otherwise negative.

Roentgen examination—Infiltration of upper lobe of right lung containing two small circular cavities.

Blood Wassermann negative. Sputum repeatedly negative for tubercle bacilli.

Bronchoscopic examination—Mucous membrane of right upper lobe branch swollen and congested, constricting lumen of bronchus so as to prevent entrance of bronchoscope. Pus in right upper lobe bronchus was irrigated weekly and weak solutions of silver nitrate were applied to the swollen mucosa. The patient has received but six treatments. The odor has ceased, the expectoration has dropped from 450 cc. to 90 cc. daily. The cough is markedly diminished. The patient has gained in weight. Treatment is being continued as outlined.

CASE IV. A. M., male, age 35, consulted Dr. Yankauer May, 10, 1920, complaining of cough and expectoration, 10 months' duration. Cough and ex-

pectoration followed an attack of pneumonia with pleurisy 10 months before and progressively increased. The expectoration is fetid. The patient has had frequent severe hemoptyses.

Physical examination—Fetor oris. Dullness, right lung posteriorly from apex to angle of scapula, with harsh prolonged expiration and numerous crepitant rales.

Bronchoscopic examination—Orifice of right upper lobe bronchus almost completely occluded with granulation tissue and exuding pus. Ulceration of bronchus just below orifice; probable origin of hemoptysis.

Treatment—Weekly bronchoscopic treatment was instituted. The granulation tissue surrounding the orifice was cocaineized, dried and then cauterized with 20% silver nitrate. The ulceration was also cauterized. The upper lobe bronchus was irrigated. The patient has received 20 treatments. The first effect of the treatment was the cessation of the odor and the attacks of hemoptysis. The granulation tissue gradually disappeared and the bronchus became sufficiently patent to admit the bronchoscope. Coincident with this was a definite decrease in the amount of expectoration. The general condition has improved. The patient is still under treatment.

CASE V. S. H., male, age 27, admitted to the Medical Service of Dr. Manges, Mt. Sinai Hospital, May 7, 1917, with a history of cough and expectoration of 10 years' duration. The past history is negative. The patient has had a cough with mucoid expectoration for 10 years, etiology at time of onset unknown. For the past four months the expectoration has been very profuse and fetid and averages 300 cc. daily.

Physical examination—Fetor oris. Marked dullness, base of left lung with diminished breath sounds and diminished fremitus and a few large moist rales. Marked clubbing of fingers.

Blood Wassermann and tuberculosis fixation tests negative. Sputum negative for tubercle bacilli. Blood and urine negative.

Roentgen examination—Infiltration of middle portion of left lung posteriorly from level of sixth to eighth rib. Nature of infiltration cannot be ascertained.

Bronchoscopic examinations—Right bronchus dilated but contains no excretion. Stricture of left lower lobe bronchus just below orifice of left upper lobe branch reducing lumen to one-third normal size. Pus coming from both upper and lower bronchi.

Treatment—The stricture in the left lower lobe bronchus was dilated weekly with the bronchial dilator and both upper and lower lobes irrigated. During the first year the patient received 51 bronchoscopic treatments. The odor completely disappeared, the cough and expectoration greatly diminished. The patient was able to resume his occupation as a chauffeur. We have never succeeded, however, in completely freeing him of the cough and expectoration. He is still under observation and reports for treatment as soon as the expectoration begins to increase and cause discomfort. Bronchial lavage gives him relief for several



weeks. In all, he has received 130 bronchoscopic treatments.

#### PULMONARY SUPPURATION IN ASSOCIATION WITH NEOPLASMS.

The frequency with which neoplasms are at the base of pulmonary suppurations is not generally appreciated. In a series of 92 cases of pulmonary suppuration referred to the Laryngological Service of Mt. Sinai for bronchoscopic examination, there were present 10 cases of lung tumor, most of which were previously not suspected. Pathological examination of sections removed through the bronchoscope confirmed the diagnosis in each case.

The possibility of bronchoscopic treatment depends upon the location and size of the growth. Benign tumors protruding into the lumen of the bronchi can be removed with bronchoscopic forceps. In the following case of long standing suppuration, removal of fibroma of the bronchus by Yankauer and subsequent treatment with irrigations resulted in a complete cure:

CASE VI. The patient, L. R., male, age 40, was admitted to the Medical Service of Dr. Brill, August 26, 1916, with the following history. He had always been well, until two years before, when he contracted influenza. Following the influenza, there remained a persistent cough with expectoration. The cough became progressively more severe, with a rapid increase in the amount and the appearance of fetid expectoration. This persisted. For the past year the fetid expectoration averaged 250 cc. daily. He has had an occasional hemoptysis.

The physical examination and the Roentgen examination show an infiltration in the left paravertebral region from the level of the fourth to the eighth dorsal vertebra. There is no evidence of cavitation.

The bronchoscopic examination reveals the entire lumen of the left bronchus, about 2 cm. below the bifurcation, to be filled with a growth. The growth was covered with normal mucous membrane. Small pieces were removed with forceps, making a lumen 3x5 mm.

Pathological diagnosis of the specimen removed: fibroma.

Examination of the chest 15 minutes after the bronchoscopy showed a marked improvement in the resonance, voice and breath sounds.

One week later the patient was again bronchoscoped and the remnants of the tumor removed. The site was cauterized with a 20% solution of silver nitrate and the bronchus then irrigated.

Bronchoscopic lavage was performed weekly for several months. There was an immediate cessation of the fetor and a gradual progressive diminution in the cough and expectoration. The interval between treatments was rapidly increased. The patient was under treatment for two years, during which period he received 75 bronchoscopic irrigations. The complete cessation of cough and expectoration rendered further treatment unnecessary.

*Malignant Neoplasms*—Until recently, difficulty in securing radium has prevented us from making direct applications to malignant neoplasms through the bronchoscope. At present, however, we are treating a case of carcinoma by this method. The patient tolerates the radium capsule in the bronchus for hours without discomfort.

#### SUPPURATION IN ASSOCIATION WITH FOREIGN BODIES IN THE LUNG.

Mention is made of this phase of pulmonary suppuration only to emphasize the fact that foreign bodies may be present in the lung without history of inhalation and may not be revealed by the Roentgen rays. The frequency with which unsuspected foreign bodies have been found in cases of pulmonary suppuration makes it imperative that every case be submitted to bronchoscopic examination. The first case of lung suppuration to be bronchoscoped at Mt. Sinai Hospital for therapeutic purposes revealed the presence of a foreign body—the vertebra of a chicken—in the involved bronchus. There was no clue in the history or Roentgen examination. The following case is also instructive:

CASE VII. A. S., male, age 3, admitted to the service of Dr. Lilienthal, Mt. Sinai Hospital, November 19, 1917, with a history of cough and fever, three weeks' duration. The past history was negative except for pneumonia five months ago. For the past three weeks the patient has had a spasmodic cough with expectoration. Expectoration never fetid. The temperature has ranged from 100° to 104°. Physical examination shows typical signs of a pneumonic consolidation at the left base and a marked clubbing of the fingers, but is negative otherwise. The x-ray reveals an infiltration of the lower part of the left lung with a small circular cavity in the upper part of the infiltration. The unusual x-ray findings, the rapid clubbing of the fingers, with the acute history were a distinct indication for bronchoscopy. The patient was bronchoscoped by Dr. Yankauer and two pieces of the kernel of a nut were found in the left bronchus and removed. The patient received two bronchoscopic irrigations and, with the exception of the clubbing of the fingers, made a complete recovery.

#### SUPPURATION DUE TO SPECIFIC INFECTIONS.

We have had no experience with the bronchoscopic treatment of suppuration associated with specific infections such as tuberculosis and syphilis. We believe, however, that the bronchoscope may be destined to play an important role in the treatment of tuberculosis, at least in the treatment of the superimposed secondary infections. We regret that the tuberculosis material at Mt. Sinai Hospital has been so limited as not to have permitted our carrying out work along this line. Suppuration in association with syphilis, the so-called luetic phthisis, does not require bron-



choscopic treatment. The possibility of its presence should be remembered.

The work on pulmonary suppuration here presented, though extensive, is not of sufficient magnitude nor duration to permit the drawing of sweeping conclusions. We merely wish to emphasize the method of treatment and the results obtained, in the hope of stimulating further interest and work along similar lines. As our methods of treatment and technique improve with experience, and as we establish the confidence of the internists and are permitted to treat cases earlier in the disease, the results will undoubtedly improve. The bronchoscopic treatment of pulmonary suppuration and other pulmonary conditions is in its incipency. The possibilities are almost unlimited. The bronchoscope should be as important a factor in the treatment of lung conditions as is the cystoscope in the treatment of bladder conditions. The present apparently limited field of bronchoscopic therapy is destined to expand into one of vast usefulness. The direct treatment of pulmonary suppuration is proving its efficacy and gives evidence of the trend in that direction.

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WORLD-HERALD BUILDING.

## SURGERY OF THE KNEE: MENISCI, CRUCIAL LIGAMENTS, AND ARTICULAR CARTILAGES.

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The recognition of traumatic lesions of the menisci, crucial ligaments, and articular cartilages has made little progress in France. These lesions are rarely recognized and rarely operated upon. We believe, however, that these traumatic lesions are an important if not the most usual cause of certain chronic conditions of the knee, which are still being treated without surgical efficiency. How many people are suffering from what was originally called a sprain, who develop chronic states characterized by frequent painful accidents to the knee, progressive atrophy of the thigh recurrent hydrarthroses? The symptoms are usually relieved by rest only to recur as soon as work is resumed. Massage, compression, hydrotherapy fail to relieve or cure. The failure is due, I

believe, to an original injury to the meniscus, the anterior crucial ligament, or the articular cartilage, and relief can be obtained only by surgical repair of the causal lesion.

The failure to recognize these lesions cannot be explained by their comparative infrequency in France as opposed to the Anglo-Saxon countries. The fault appears to be due to the inadequacy of arthrotomies performed, and to the tendency to over-emphasize the importance of the menisci.

The lateral, vertical and horizontal incisions, as presently used, are sufficient to expose the meniscus, but that is all. These incisions do not permit complete exploration of the knee joint. If then the surgeon does not immediately find the suspected lesion in the meniscus, he is faced with the alternative of closing the wound or uselessly removing a meniscus. At the present time fear of infection should not deter us from attempting the most thorough possible exploration of the knee joint.

Two methods of arthrotomy are at our disposal, both of them good, both permitting perfect restoration of the joint. They have been employed for several years in foreign countries.

*Vertical, Median, Trans-Patellar Arthrotomy* is simple. The incision is made in the quadriceps above the patella, in the patellar ligament below the patella, and completed in my two cases, by the liberation of the patellar ligament from the tubercle of the tibia. This permits the dislocation outward of each half of the patella onto the anterior surface of the femoral condyles. The exposure is perfect. The only disadvantage is the slight intra-articular bleeding which occurs from the cut edges of the patella.

The second method is to cut a *large U-shaped flap*, of which the horizontal branch passes underneath the tubercle of the tibia, which is cut with the chisel or Gigli saw. A large flap can then be raised upwards, consisting of the insertion of the patellar ligament, the patellar ligament, the patella, and a portion of the capsule. The exposure is the same as in the first method. The repair is effected by re-attaching the tuberosity with a screw or by carefully placed fibro-periosteal sutures. The advantage of this method is the absence of bleeding, but the operation is longer than with the first method.

It goes without saying that with either method, the suture of the synovia, capsule, muscles, and prepatellar tissues should be most carefully performed, with fine suture materials. This is absolutely essential in order to obtain good functional post-operative results.



**MENISCI**—The two cases which I observed presented absolutely typical histories. Both were adults. In one the original injury dated back five years and was acquired at football, the other dated back only five months and was acquired at ice skating. In both cases the typical locking occurred with increased frequency, and on minimal effort. The locking was accompanied by the usual symptoms of sudden acute pain, in the internal part of the knee, with immobilization in semi-flexion. Under the influence of rest and progressive traction, reduction would be accomplished, and after a few days the patient would resume his occupation, but with a leg more feeble, less sure and more atrophied after each locking.

I operated upon these two patients. The first through a simple lateral incision, the other through a transverse incision dividing the patellar ligament. The first incision is insufficient, not permitting extensive exploration, the second is mutilating and I now prefer either vertical section of the patella or the detachment of the tubercle of the tibia.

In both of these cases, the internal meniscus was found completely detached, atrophied, and deformed, and in the case of long standing, twisted on its axis, almost filiform in thickness, and sliding backwards and forwards between the two tibio-femoral articulations.

This is the easiest type of meniscus separation to diagnose, when the torn meniscus is caught between the two articular surfaces. But in certain cases of very long standing, the course may be quite different, and the diagnosis may be a little more difficult. In this type the frequent locking of the joint, and its functioning under abnormal conditions, has created an inflammatory condition, and manifested by a chronic hydrarthrosis, pronounced atrophy and progressive weakness. The painful locking is now not so necessary to the diagnosis, but in all cases it has occurred at some period of the disease. There is a history of trauma, which should direct suspicion to the mechanical origin of the disease. However, only a complete exploration of the joint will produce a definite diagnosis, and allow a rational therapy.

**CRUCIAL LIGAMENTS**—A review of the recent literature on this subject seems to show that while in France the tendency has been to operate too little, in England the contrary is true. Over-emphasis on the importance of lesions of the meniscus has led to the removal of many healthy menisci, unnecessarily, in the same way that many healthy appendices are removed.

As with appendicitis the causes of error are numer-

ous! In the first place the hitherto insufficient exploration of the knee-joint, and in the second place the over-emphasis on lesions of the meniscus and overlooking of lesions of the anterior crucial ligament.

The pathognomonic symptom of a torn or dislocated meniscus is a painful locking of the joint. The other symptoms, hydrarthrosis, atrophy, and weakness are secondary, and occur also in other pathological conditions in the knee joint.

When an operator, in expectation of finding a torn or displaced meniscus, finds an apparently normal one, he is very much in the same predicament as the surgeon who has found a normal appendix unexpectedly. A slight redness or increased mobility has been sufficient indication for removing the meniscus, or performing a meniscopexy.

In reviewing the abundant statistics published by the English, one is struck by the fact that whereas the results are remarkably good in those cases where the meniscus has been definitely torn or displaced, they have been practically very mediocre or poor in those cases where the lesion was not definitely present. *The reason for this lies in the fact that the true pathological condition was overlooked because of the inadequacy of the incision usually employed.*

In addition, as pointed out by Alwyn Smith, it is often possible to have with a true lesion of the meniscus, a coincident tear in the anterior crucial ligament. It is therefore conceivable that ablation of the menis-

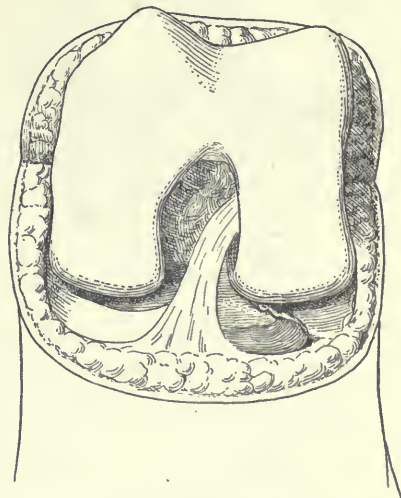


Fig. 1. Old displacement of the internal meniscus. The meniscus, filiform, is turned on itself, passing directly between the two articular surfaces of the femur and tibia.

cus alone without further exploration has accounted for a certain number of failures, even where a torn meniscus was definitely repaired.

Wide access to the joint will minimize the number of errors, and therefore whenever arthrotomy is per-



formed, the exposure should permit a satisfactory exploration.

Without going into the details of the physiology of

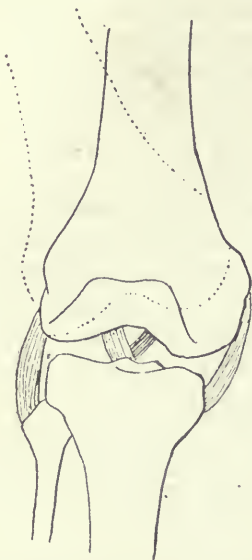


Fig. 2. The movement of abduction causes the most tension on the internal lateral ligament and the anterior crucial ligament. (After Corner).

the crucial ligaments, the important fact is that these ligaments are the strongest connections between the

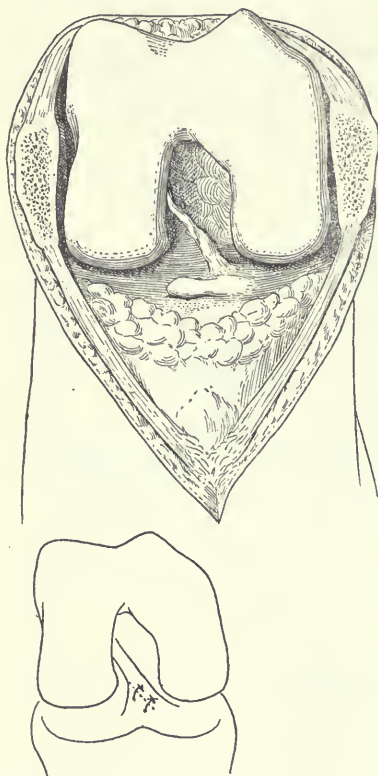


Fig. 3. Case I—Almost complete rupture of the anterior crucial. Ligament sutured.

tibia and the femur. Any weakness in these ligaments causes a laxity in the knee joint. *The syndrome of*

*torn meniscus is essentially characterized by pain, the syndrome of the crucial ligament tear is essentially one of laxity and weakness.* At the onset there is usually a profuse hemarthrosis, followed later by increased lateral motility, progressive weakness, lack of confidence in the affected limb. The patient fears to put his entire weight on the injured side and there is resulting atrophy. The symptoms occurring with painful accidents resulting from a "pinching" of the fragment, so frequently in "old sprains," in "intermittent hydrarthrosis," should direct suspicion towards the possibility of a rupture or displacement or atrophy of one of the crucial ligaments.

It is nearly always the anterior crucial ligament which is affected. In causation it is similar to that of tear of the internal lateral ligament. Both of these



Fig. 4. Case I—Rupture of anterior crucial ligament of the knee. Vertical, median, trans-patellar, arthrotomy. Suture of the ligament. Condition two months after the operation. Right knee.

ligaments suffer similarly when the knee is flexed, externally rotated, and abducted, which is the position in which most traumatisms occur.

Following are two cases of rupture and of relaxation of the anterior crucial ligament.

CASE I. L———, 19 years. First injury three months previous. While vaulting a fence, he fell, had severe pain in knee and was unable to rise. Immediate swelling of the knee. Six weeks of massage and the patient resumed work. Since then, frequently after mis-steps, he has had violent pain and



immobilization of the leg for an instant. Recently these attacks have become more severe, the last one, especially bad, bringing him to the hospital.

The knee was swollen and fluctuating; thigh markedly atrophied; flexion limited to a right angle; lateral motility; x-ray shows nothing abnormal.

Operation, December 3, 1918, at Hospital 34, Troyes. (Assistant M. Fournier; ether, M. Bureau.) Vertical, median, transpatellar, arthrotomy. Vertical section of the patellar ligament. Separation of this ligament from the tibia, at the tubercle of the tibia. The articulation contained blood, but no clots. Menisci intact. But the anterior crucial ligament was almost completely torn, shaped like a flattened stump, resting flat on the tibial surface, and attached only to the tibia. It was covered by a layer of fibrin, which when lifted off, disclosed clearly its ligamentous structure.

Behind this stump and hidden by its fatty fringes, there persisted the deeper portion of the ligament which maintained its tibial and femoral insertions. To this intact portion I sutured the torn tibial end of the ruptured ligament with fine linen suture. Suture of the synovia, the capsule, periosteum of the patella (fig. 3). Plaster cast.

On the ninth day the cast was removed. On the twelfth the patient was out of bed, and began regular active exercises in flexion and extension of the knee.

On February 6, 1919, two months after the operation, there was flexion to a right angle, only slight "floating" of the patella, the knee was much more solid than before the operation, the acute painful accidents and locking had not recurred, and the atrophy of the quadriceps was slowly improving. (Fig. 4.)

CASE II. V———, 20 years old. Beginning of trouble dated back six months. In attempting to throw a hand-grenade he fell, had very severe pain in the right knee, and at the same time he felt something crack. Progressive swelling of the joint. Massage and cautery. At the end of three weeks he returned to service. Since then he noticed occasional sharp flexion of the joint, culminating in a second acute accident similar to the first, which brought him to us.

The knee is large, painful, especially anteriorly, around the patellar ligament. Extension fairly complete; flexion limited to a right angle; lateral mobility; atrophy of the thigh. Walks with a limp, and has sensation of extreme weakness in the limb. Radiograph is negative.

Operation, January 2, 1919, at Hospital 34, Troyes. (Assistant, M. Fournier; ether, M. Bureau). Median, vertical, trans-patellar, arthrotomy, vertical section of the patellar ligament, separation of the insertion of the patellar ligament at the tubercle. Hemarthrosis. Menisci intact. The anterior crucial ligament very loose and swollen. The laxity was diminished by suturing the tibial portion to the fibrous formation in the vicinity. (fig. 5). Suture of the synovia, capsule, patellar periosteum. Plaster cast.

On the ninth day, removal of cast and sutures, patient out of bed, physical therapy begun.

On February 6, 1919, 34 days after the operation,

there is still a slight swelling of the knee. Flexion is still limited to 95°, (fig. 6), the patient has the sensation as if the anterior part of the knee had been shortened. There is still slight lateral mobility, less marked than before the operation. The patient states that his knee feels more solid. Sudden flexion no longer occurs, his walk is normal, even rapid. He ascends stairs easily, descends stairs with slight hesitation when the injured knee is flexed the sound leg is brought to the step below.

The reparative work which is performed in the narrow inter-condylar channel, should be done with fine and short needles. Besides the handicap of the narrow working space, the suture of the ligament is

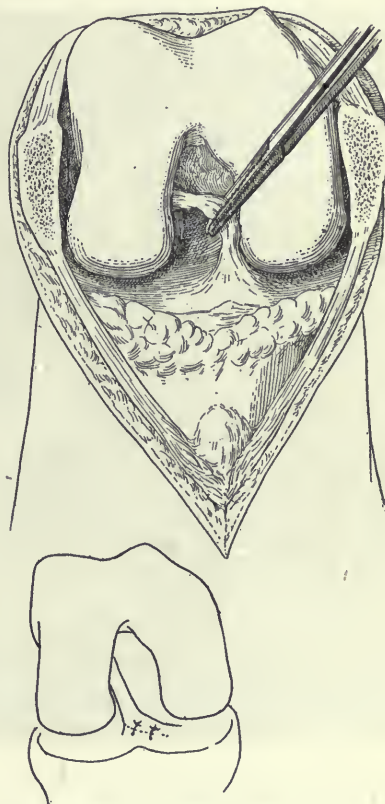


Fig. 5. Case II—Laxity of the anterior crucial. Suture of the ligament. Right knee.

not a particularly easy problem, and numerous methods have been devised:

Corner has attempted to shorten and tighten the ligament by what he terms "reefing" the ligament. The suture is passed through and around the crucial ligament, the two ends are carried through the external condyle and tied on its subcutaneous surface (fig 7.) Thus after a fashion the ligament is hugged against the articular surface of the condyle and held taut. The question may be asked whether this tension is adequate and especially whether it is permanent.

Moreover, all operations performed upon a diseased ligament more or less atrophied, relaxed or torn,



are open to the same criticisms, as all plications or "pexies." The repair has little value because the tissues used are poor material.

Much more interesting are those operations which attempt to create a new crucial ligament either with a strip of fascia lata for the anterior crucial, or a strip of semi-tendinosus for the posterior crucial (exceptional case).

These operations have been performed by Hey Groves, later by Alwyn Smith, whose complicated operation proposes not only to restore the crucial ligament, but also to reinforce the internal lateral ligament. The knee is widely exposed by a large U-



Fig. 6. Case II—Relaxation of the anterior crucial. Suture. Condition 34 days after operation. Right knee.

shaped incision, the inner limb of which extends upwards to the middle of the thigh. A narrow strip of fascia with its pedicle below is cut in the fascia lata. The knee is opened and the external femoral condyle and then the internal tibial condyle are crossed by osseous tunnels the intra-articular orifices of which correspond to the points of insertion of the anterior crucial ligament to the femur and tibia. The fibrous band is passed through this tunnel by means of a catheter in whose terminal eye is threaded the end of the fascial strip. The knee is now extended, and the fascial strip sutured to the periosteum of the tibia and the neighboring fibrous tissue. Here the operation of Hey Groves stops. (fig. 8.)

Alwyn Smith, in order to reinforce the internal lateral ligament, cuts a strip of fascia long enough to be carried upwards on the internal surface of the joint. It lies in another osseous tunnel made in the superficial part of the internal condyle of the femur, passing up to the tubercle where the third adductor is attached. At this point the strip of fascia is anchor-

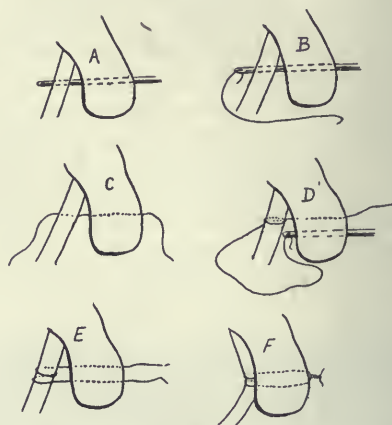


Fig. 7. Corner's operation for tightening a relaxed ligament.

ed (fig. 9). These operations seem to have given good results. Their true value will depend upon a larger experience.

ARTICULAR CARTILAGES—I have observed one case in which there was a fracture of the articular cartilage of one of the femoral condyles, and in which the fragments acted as cartilaginous free foreign bodies.

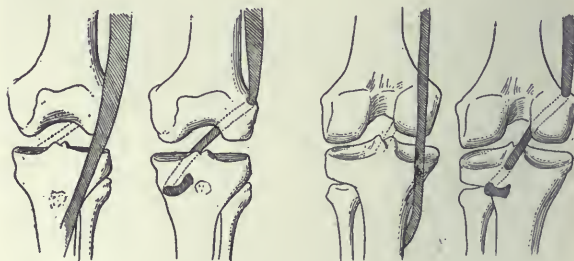


Fig. 8. Operation of Hey Groves. Left: Construction of an anterior crucial ligament from a strip of fascia lata. Right: Construction of a posterior crucial ligament from the semi-tendinosus.

CASE III. D—, 23 years old. In July, in falling from a vehicle, he twisted his leg in extreme rotation and arose with difficulty. Articular effusion. After ten days in bed he returned to duty. Then in December two similar accidents, one while jumping from an automobile, the other in making a severe bodily effort. In addition there are constant sensation of weakness, limitation of movements, and on severe effort pain on the internal aspect of the knee. The knee is swollen and fluctuating. Pronounced pain at the site of the internal meniscus. Flexion to right angle only. Lateral mobility in extension. Considerable atrophy of the thigh. Radiography negative.

Operation, December 30, 1918, at Hospital 34, Troyes. Assistance as in Case II. U-shaped incision



ion. Section of the tuberosity of the tibia. The entire joint is exposed.

The following lesions were discovered: 1. A free oval shaped cartilaginous foreign body, resting on the internal tibial plateau, 2 cm. by 1 cm. in area, and

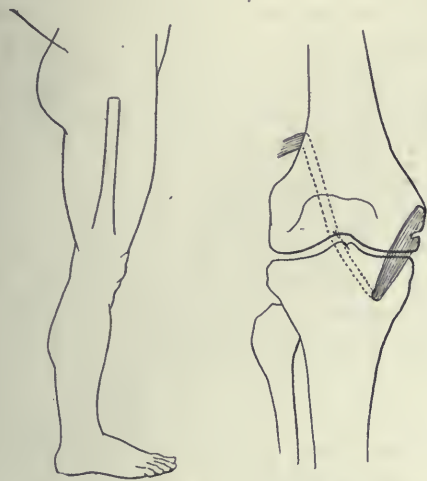


Fig. 9. Operation of Alwyn Smith for the restoration of a ruptured anterior crucial ligament and the reinforcement of the internal lateral ligament. Left. Cutting the strip of fascia. Right: The flap traverses the femur and tibia, and is attached to the adductor tubercle.

2 mm. in thickness. One of its surfaces was perfectly smooth, the other slightly rough and striated. 2. A pedunculated mobile foreign body, 1 cm. by 5 cm.



Fig. 10. Case III—Fracture of the articular cartilage. Free and pedunculated foreign bodies. Right knee.

attached to the intermeniscal ligament by a band which we divided. 3. A free foreign body, soft, probably consisting of a fringe of synovia. 4. On the articular surface of the internal condyle there was a loss of substance of the cartilage equivalent in size

to the dimensions of the foreign bodies. All around this area, the cartilage was dull and grey, and at the outer edge of the denuded area the loss of substance was limited by a fragment of cartilage, almost entirely detached and ready to separate. Excision of this fragment. The menisci were intact. Suture in the usual fashion. Plaster.

On the ninth day, plaster and sutures removed. On the twelfth day out of bed, beginning to walk and taking graded exercises.

On February 6, 1919, 38 days after operation, flexion almost normal. Patient walked without pain or limp. All sensation of weakness or giving way had disappeared, except in going downstairs. Ascends stairs easily. Cannot run.

On April 25, the patient could run and play foot-



Fig. 11. Case III—Right knee. U-shaped Arthrotomy, with section of the tubercle of the tibia. Removal of foreign bodies. Condition of the knee 38 days after operation.

ball. Slight amount of fluid in the joint. Flexion normal.

This is a typical case in which clinical diagnosis was absolutely insufficient, and in which the condition could be cleared up only by wide exposure.

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MEATOTOMY—ITS INDICATIONS AND  
TECHNIQUE.

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It quite frequently becomes necessary to enlarge the male meatus urinarius for purposes of instrumentation for the diagnosis and direct treatment of intra-meatal lesions. The latter, however, do not call for such interference as often as an abnormally small meatus, that has to be amplified for the insertion of instruments to relieve deeper urethral lesions. In suspected affections of the fossa navicularis especially in the involvement of the glands of Littre; and the follicles of Morgagni, it is good diagnostic sense to locate the lesions endoscopically; with an abnormally small meatus, however, this is impossible. The operation of meatotomy aids us materially in the treatment of the above conditions; it is of far greater importance, however, in deep seated lesions invading the pendulous membranous or prostatic segments of the urethra. But when a meatus does not admit the requisite caliber and kind of instrument, we are unable to reach the seat of the pathologic process, and in all such cases a meatotomy is indicated.

## INDICATIONS FOR A MEATOTOMY.

What constitutes a normal meatus?

Under normal conditions the size of the meatus is a negligible factor, so that we cannot definitely lay down criteria as to the physiological size of the orifice. But in pathological states, we must ask ourselves what is the smallest size of the meatus compatible with the proper treatment of deep urethral affections?

If small caliber strictures are taken into consideration, then No. 20 orifices may be regarded as of sufficient size for dilatation up to twenty-two mm. But if urethroscopic or other instrumental intervention is called for, a twenty mm. opening, though perhaps sufficiently adequate for ordinary purposes and observations, may and does offer serious difficulties, when we have to remedy large caliber strictures from 20 to 35 or 36 mm. A meatus of 20 mm. offers a considerable obstacle, especially so when the deeper urethra is patulous enough to admit a sound of large caliber. We can thus formulate almost axiomatically that for endoscopic intervention and dilatation of large caliber strictures a meatal orifice of only twenty mm. is sufficient indication for meatotomy.

## TECHNIQUE OF MEATOTOMY.

Meatotomy is a singularly simple operation that does not call for superior surgical skill, nor for any array of complicated surgical apparatus. A sharp scissors, either curved or straight (I prefer the lat-

ter), a few hemostats, a fine wick of gauze, a probe, a four per cent. solution of procain, solution of adrenalin, 1 to 1000, and dressings are all that are required. A pledget of cotton, well saturated with the procain solution, is inserted into the meatus and retained for ten minutes; the glans is well sterilized with sublimate of lysol solution, the pledget of cotton is then removed and the meatus is lightly touched with the point of the scissors, so as to determine whether its sensitiveness has been thoroughly abolished. If it still remains sensitive, we must repeat the procainization of the meatus. The scissors are then introduced into the meatus, the penis elevated at right angles with the body, the lower blade impinging upon the mucosa, the upper blade externally to it in juxtaposition to the lower blade; and thus bringing the blades together with one sweep, the meatus is divided. The question may be asked to what caliber should it be enlarged, and how can we gauge the extent of the enlargement? In order to establish a free and patent meatus, we must think of the possibility of shrinkage and cicatrization that is apt to follow after healing has taken place. We must not be sparing in our efforts to maintain a fairly large orifice; consequently the urethra should be divided to the size of 26 mm., which in the course of healing is invariably reduced to 24 or 25 mm.

How can we measure the extent of a meatotomy to correspond to a 26 caliber sound? This is a personal equation and depends upon the judgment and experience of the operator. But with repeated practice one readily acquires the ability to judge. After the incision has been made, there may be considerable bleeding, which is readily controlled either by the hemostats, which is very rarely necessary, or by ordinary compression by the subsequent dilatation with sounds. A 24 sound is introduced, rapidly advanced to 26 mm, and collectively retained for ten minutes. A fine wick of gauze, saturated with chlorotone oil, is inserted into the meatus and the penis is bandaged. The patient is told to remove the dressing upon the first attempt at urination, to withdraw the wick and to spread the enlarged meatal lips five or six times a day with his fingers, so as to obviate adhesion of the cut edges. He must be cautioned to have his hands thoroughly washed before attempting this. The patient is to return daily for six subsequent days, and the same collective dilatation repeated as on the first occasion. It is advisable to lubricate the meatal lips either with chlorotone oil or petrolatum and to have the wick of gauze retained at least one hour after dilatation. The entire process occasions very little pain or discomfort; the subsequent dilatation



of the enlarged meatus prevents its premature closure or its undue subsidence to less than 24 mm., which would frustrate our end in view. Complete healing ensues within two weeks, after which instrumentation and the necessary therapeutic measures may be carried out with the free and large meatal orifice thus established. At times we note encircling the severed edges of the meatal lips, a tightly adhering film or pellicle, the first attempt at cicatrization, which disappears in the course of time. No untoward after-effects have been observed in my cases, and no complication whatever need to be anticipated if proper asepsis has been employed.

In conclusion, it may not be amiss to emphasize the fact that aside from the patency of the meatus thus afforded by the operation for purposes of instrumentation or therapeutic measures, it is also conducive to better drainage of secretions, which would otherwise be retained, or only partially discharged if we had to deal with an abnormally small orifice.

507 FINE ARTS BLDG.

## HAS THE RUBBER GLOVE SOLVED THE QUESTION OF HAND INFECTION?

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(From the clinic of the Joseph Price Hospital.)

Some apology is due the earnest profession at this late date for the selection of this subject. It has never been sufficiently clear to me just why we are not able to teach surgical cleanliness to the majority of our profession. The more I live the surgical life, the more forcibly is the fact impressed upon me that a very few can be taught ideal surgical cleanliness. The brilliant student of today, educated to the ultimate degree, comes to us with a very feeble idea of just how to get and keep his circle of surgical cleanliness. To him who received his education in surgery, or rather who undertook surgery late in his life, say fifty, it is hard, indeed, and next to impossible, to teach a refined degree of surgical toilet of the hands.

As a student, it seemed to me not necessary to give a prolonged course of lectures on asepsis; the single statement that the habitat of bacteria was ubiquitous should have been sufficient to teach the unyielding rule of hands-off of all unsterile surroundings. It should have remained only for the teachers to demonstrate the methods by which refined degrees of surgical cleanliness can be obtained. This, unfortunately, is an indefinite factor, and must ever vary with the psychology or mental attitude of the teacher as to what is the most refined degree of surgical

cleanliness. One teacher talks about length of scrub, another about system of hand-scrubbing, another says little about scrub, and much about the rubber glove; another talks fluently about asepsis and antisepsis, and but feebly practices either.

It is very difficult to define, corner or circle the subject on account of operators' attitude as to what is right. For instance, I illustrate from a personal experience: Two operators dealing in critical comment, one a believer in long scrub and operating with glove-less hands, condemns another who believes in gloves and takes an inferior scrub. I was condemning both; the long scrub had not been conducted with system and method, and the gloved operator was condemned on account of his very inferior scrub, and the liberty he early took with gloved hands. So, here are three opinions of what each considered right. There is but one answer, and it howls with truth, namely, results. It is ignorant, unnecessary and unscientific that there has not been a consistent and gradual elimination of operative infection from the dawn of asepsis to the present day.

Much I see in surgery has been of gross neglect in carrying out the fundamental principles so well established. Have men the patience to get clean? Have they sufficient habits of industry to do so? Have they the actual strength and endurance to get clean? Can they think constantly in the circle of cleanliness? The late Dr. Price so often said that abdominal surgery should be done by the surgical prize-fighters of our country, by which he merely meant that it took much strength, endurance and habits of industry to make the proper toilet of one's hands and stand the blow of surgery. In any month's history of the Joseph Price Hospital the time consumed in the toilet of the operator and assistant's hands, has been greater by far than the time consumed in the actual operation, and we talk little about length, but much about the system of the scrub. It has been my observation for some years that puerperal infection is on the increase. Statistics of large insurance companies and many publications are at present confirming such observation. We are not any more unclean in our obstetrics than we are in our surgery, but neglect is stamped upon the obstetrical patient because she represents a single type of case and one of high mortality,—a fact registered by the death certificate. The mortality in abdominal surgery is much too high. Substitutions are double-edged instruments; be careful of the conscience appeasers in surgery. Best results do not come as accidents, nor are they obtained along lines of easiest



execution, but are achieved only through earnest habits of scientific industry. There is a very definite limit to the number of major operations any operator can perform with the very best results. He has his legitimate limit, more is reprehensible. I question, and the courts, I believe, sustain me, whether any operator is within his professional rights when he does not finish the operation he began. A great abdominal surgeon said to me, he could tell from the convalescence of his patients whether a second finger had entered the abdominal cavity. I believe the best results are just so sensitive. Abdominal surgery will not inherit its own until such refinement is lived up to. That great cricle of assistants, which is too often seen in public clinics, must be shortened. Too many hands, too many possibilities for error. Simplicity is mighty in abdominal surgery.

In review of one thousand re-operations in abdominal surgery performed in my institution, ninety-nine per cent showed adhesions to or lateral to the scar. Most of these operations had been by operators with gloved hands. One could not claim that all such adhesions came from infections; other sources such as trauma, imperfect surgery, rough use of instruments, the materials used, etc., must be taken into consideration. About seven per cent of our own cases, re-opened subsequently, showed signs of adhesions, yet we do not use the rubber glove.

Can you teach men to scrub their hands? I doubt it. Should the rubber glove be put on the hand of the man who will not scrub, and not on him who will? Loss of time, extra trauma, less perfect work, poorly scrubbed hand in the imperfect glove, may be fair to consider attributes of the rubber glove, and must be pitted against the ungloved clean hand with all its natural abilities. How much work can the perfectly scrubbed hand stand? If you force me to committal I say, the imperfectly scrubbed hand is the source of infection, the rubber glove has not solved the question of hand infection, and has obtunded the aseptic conscience of the operator who takes privileges with the glove he would not take without it. The scrub of many operators who wear rubber gloves is a perfect farce.

#### HAND SCRUBBING.

The teachers must stop talking so much about the time required in hand toilet, and talk more about the method and system of the scrub. In the Joseph Price Hospital we use six different brushes and as many different basins to scrub in. Analyze the scrub of one who begins and ends with the same brush, and it

must be apparent that the brush in the first twenty seconds contains ninety-nine plus per cent of the filth of the hands and continues to be diluted only as the hand scrub goes on; it is never perfect. The change of brush and receptacle is all important and most imperative. The scrub requires just as much mental concentration, and is the hardest work I do, and the most important. The hand-scrub in the Joseph Price Hospital is done with as much West Point discipline and organization of technique as we are able to carry out.

The hand is first washed with soap under a running stream before the first brush is used. A gross portion of the cleansing is thus accomplished before the first brush is contaminated. The scrub is then continued through six large receptacles or basins with six changes of brushes; the hand and fingers being scrubbed in hyperflexion and hyperextension in order that the crevices and wrinkles may be effaced, enabling the brush to pass thoroughly over the entire surface of the skin. Each finger is given a special toilet; the nail cleaner should be used several times as the scrub goes on; once is not enough. The scrub ends in the alcohol basin. There is just as much mental effort used in this preparation as there is in the operation. So, when I hear an operator talking about the time of scrub and little about the quality of the scrub, I feel he has failed to teach the subject. Much that is of vital importance fails of accomplishment on account of its very simplicity. I have every encouragement possible which may be brought to my notice to continue my abdominal surgery with gloveless hands.

In twenty years' experience in the Joseph Price Hospital, serving a ten-year apprenticeship under Doctor Price, and during my ten years conduct of that institution, I have seen but one death from appendicitis *per se* (where the abdomen was closed) and that was in a patient with cirrhosis of the liver. The mortality in an operation with greater possibilities of infection, such as suprapubic and vaginal hysterectomy, has remained a fraction of one per cent. May I continue to operate with gloveless hands?

The hand can be surgically cleansed. Will we take time to do it? That is the only question requiring answer. Robert Morris, a skilled operator and brilliant teacher, has done much to point out the errors of the rubber glove, and much that he has said on this subject is of vital importance to the profession. Were I asked if I would advise the profession to discard the rubber glove, I would say no, not by a



great deal. I have often advised a man who was going to assist me to put on the rubber gloves. I knew I could not scrub that particular doctor, and as an assistant it was not necessary for him to have any degree of dexterity. The glove has a very important function in protecting the surgeon and also in helping to keep the operator clean when doing any kind of pus work, when other operations must follow. The glove may be used to its greatest advantage where dexterity and sensitiveness of finger is not profoundly required, such as instrumental bone work, etc. Especially is this true of the operator who just will not scrub.

241 NORTH 18TH STREET.

## THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM.

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(Concluded from the February Number.)

### V. SPECIAL SURGICAL PROCEDURES

In the previous section we have described the surgical procedure to be followed in the more typical cases of septal deviations. But in these cases, as in all operative work, the surgeon often finds unusual conditions which tax his skill and ingenuity. Some of these exceptional cases occur frequently enough in a long experience to establish a procedure that may itself be standardized. We shall describe some of these cases, with suggestions as to ways to meet the special conditions.

There are deviations of the non-descript type which exhibit a well marked spur or ridge. In these cases it will be found that the septum after being thrown out of the normal position has bowed, so that it is convex on one side, and more or less concave on the other. These spurs commonly have at their extremities well-defined crests. On the concave side, toward the anterior part of the nose, there is more or less of a gutter, the depression becoming more marked in the posterior region. This ridge and depression are found to extend back in most cases over about two-thirds of the length of the septum.

In special cases of this ridge and depression type, the incision is made at the usual position, as described in Section IV. If the concavity of the septum

occurs on the left side, the mucoperichondrium is first separated from the crest very carefully with a small knife of the Ballenger type. The original incision is then prolonged to the outer side of the nose near to and a little forward of the lower tip of the inferior turbinate, as in the regular procedure. The flap will then lie at an acute angle, leaving abundant space, a very necessary requirement in these cases calling for extra caution. The loosening of the membrane should be done with great care, using the curette end of the elevator, as illustrated in figure 16, and separating very gently with an outward motion from the gutter, at the same time keeping the curette in the groove. The greatest caution will be found necessary at the point of deepest depression, usually opposite the sharpest point of the spur and in a posterior position on the septum.

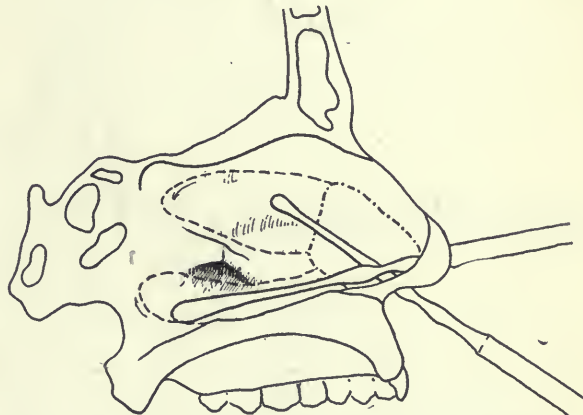


Fig. A-1. Diagrammatic drawing showing positions of Dunning's curette elevator in loosening membrane above and below spur.

Such is the procedure when the ridge lies on the left side. In dealing with cases presenting a well-defined groove on the right side, remove with the curette a part of the cartilage just behind the original incision, separate on the concave side, and proceed as before. It is a matter of observation that these spurs are found on the right side in the greater number of cases, and if we recall that they are traumatic in origin the reason is evident because of the ordinary incidence of blows from a human source.

After the removal of the anterior portion of the cartilage, it is well to continue the separation higher up with the curette end of the elevator. There is less danger of tearing the membrane with this instrument. (See figure A-1, first position.) Then changing to the other end of the elevator, continue the separation by pushing gently upwards and backwards. There will usually be little difficulty in separating the membrane down to the point on the spur where the convexity is causing tension with consequent thinness of the membrane. (See second position, figure A-1.)



In the majority of these cases with the spur and ridge, posterior to the sharpest point of the deviation the septum after a gentle curve falls back to the perpendicular. In such noses, smell may be fairly normal except from some secondary difficulty, but breathing is apt to be seriously interfered with. This is because usually the bone behind the spur was not affected by the original injury. But in cases where

nose upwards and backwards for a distance nearly half the length of the septum. The situation has so far been relieved back of the spur. We now start in front of the spur and near the floor of the nose to separate up to where the mucous membrane thins again. Bite through at that point with the forceps. (figure A-3.) By this time the spur is so completely loosened that a gentle push with the curette will cause it to separate from the membrane, when it can

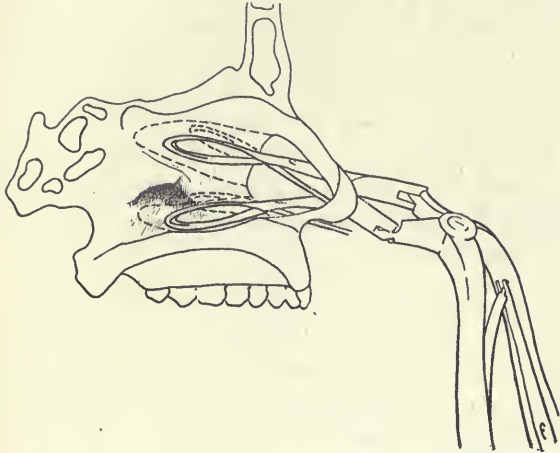


Fig. A-2. Showing Jansen-Middleton forceps biting away cartilage and bone above and below spur.



Fig. A-4. Showing removal of spur with curette.

be removed from the nose without difficulty. (figure A-4.)

Another case calling for variation from the usual procedure, and almost as common as the spur and

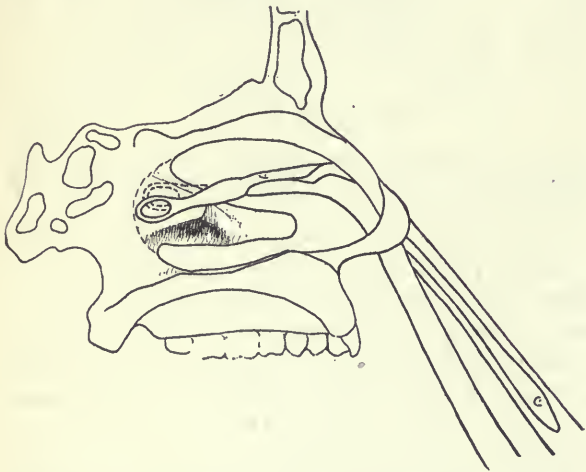


Fig. A-3. Showing punch forceps biting away bone and cartilage back of spur.

the bone is affected, the cartilage and bone high up and near the spur may be removed by inserting the Jansen-Middleton forceps and biting them away, as illustrated in figure A-2. This procedure will relieve the situation above the spur. Then take the forceps, go in back of the spur and press down gently. This gentle downward pressure will separate the membranes, which are usually loosely adherent posterior to the spur. This will also break down the posterior attachments of the spur, which as a rule extends from a position near the floor in the anterior part of the

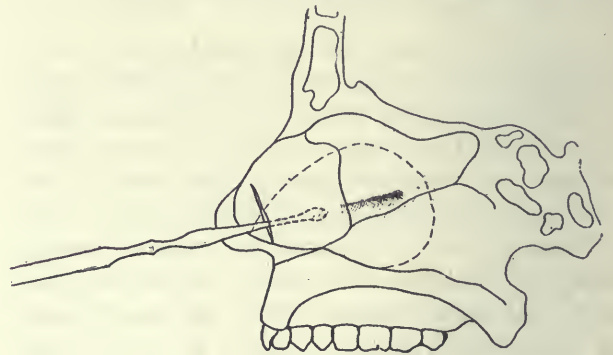


Fig. 16. Showing curette loosening membrane along groove.

groove, is a result of the breaking, or more correctly, the smashing of the septum, with both bone and cartilage involved. As a result of this injury there has been a formation of fibrous tissue with adhesion of the membranes on both sides of the septum. To deal with these cases, open up the incision in the usual way. Use a curette to gain space. It will usually be found advisable to continue the use of the curette until the line of cleavage has been located. After this point has been reached the usual procedure applies, except that it may be necessary at times to use a knife in loosening the adhesion.

We have already alluded to a type of deviation in which the deflection is almost at right angles to the



perpendicular line, with a cul-de-sac formed by dislocation in a posterior position. The formation of fibrous tissue which has resulted completely separates the two severed portions of the septum and unites the muco-perichondrial surfaces. In such a case, make the usual incision and separate the membranes on both sides up as far as the cul-de-sac. Then with the curette or forceps remove all the cartilage except the ridge above. (figure 17.) Working high in the nose, separate the membranes behind the cul-de-sac and on the concave side. They are usually not so adherent in this region. Then curette through on a line a short distance posterior to the sharp angle, removing the cartilage but leaving the ridge. After this stage is reached, the procedure becomes



Fig. 17. Diagram showing curette scooping out cartilage on both sides of cul-de-sac.

the usual one. It is to be noted that in this case there are two curettes through the cartilage, one anterior, the other posterior. When this has been done and the adherent membranes loosened, hook the cartilage at the high point and bring downward and forward with a sweeping motion toward the opposite side, thus removing the obstruction. (figure 18.)

Inasmuch as it sometimes happens to the most careful operator that he punctures or tears the opposite membranes, it is well to know how to remedy them. The following procedure devised by the writer gives excellent results in a large number of cases: Drive a needle, preferably of the style of Yankauer's curved suture needle threaded with silkworm gut, well into the tissue anterior to the incision and low down near the floor of the nose. Then push

the needle upwards and backwards so that it will cross the line of the incision as high as necessary in the nose. After the needle is in position, holding the gut with angular forceps withdraw the needle. If the perforation is small, it is unnecessary to reach as high on the membrane. But if the perforation is large then separate the mucous membrane as high as

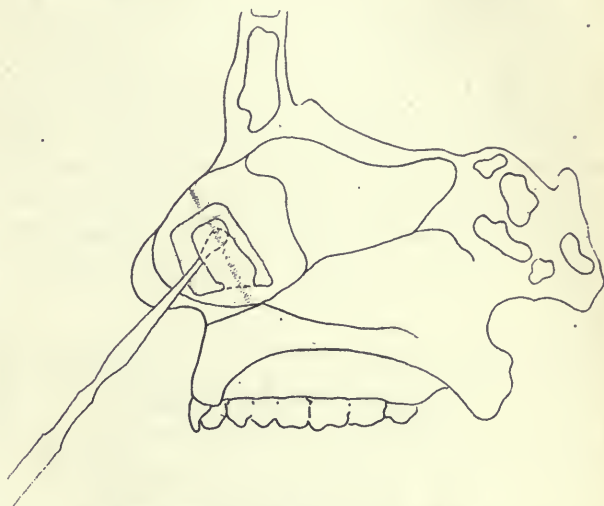


Fig. 18. Showing curette hooking cartilage at high point and removing obstruction, after clearing away cartilage about the base to facilitate breaking.

the bridge of the nose, cutting with a knife from the side on which the flap is being made, as illustrated in figure 6. The membrane having been loosened enough to allow the flap to fall into position (see figure 19) the suture is drawn with a running loop

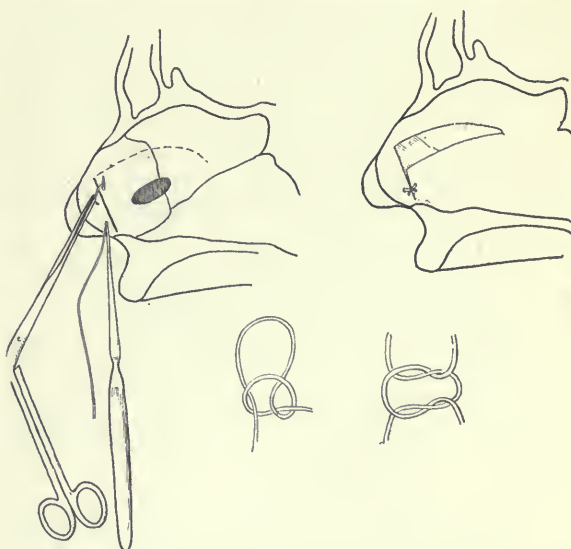


Fig. 19. Diagrammatic drawings of procedure in closing perforation, showing position of needle and angular forceps; also suture, together with knot used in tying silkworm gut. (figure 19) and afterwards tied with a surgical knot. On account of the free circulation of blood in the septum there is practically no danger of a necrotic flap. Pack the nose lightly and not too far posterior,



to avoid ear difficulty, using vaseline gauze. In 24 hours the gauze may be removed on the opposite side; in 48 hours on the side on which the perforation has been repaired. The suture is left in position several days, until it begins to cut itself out.

It is in these special cases that the operator on the septum finds his greatest difficulties, just because they confront him with unexpected conditions. But patience and skill and a cool head combine with the knowledge of the experience of others to simplify the problem. As these special cases give the greatest difficulty to the patient also and call most insistently for correction, the writer feels justified in the attempt to describe a procedure which calls more urgently for a skillful hand than for language, and which is therefore hard to translate from action to words.

## Communications

### EXTERNAL ALVEOLECTOMY

209 Post Street,

San Francisco, February 8, 1921.

Editor, AMERICAN JOURNAL OF SURGERY,

In the *Journal of the National Dental Association*, June, 1920 appeared an article on "External Alveolectomy" for the removal of dead teeth and their pathologic products by William Lete Shearer, M.D., D.D.S.

Dr. Shearer summarizes the operation that he describes as follows: A. Novocain nerve block anesthesia; B. The teeth are removed, the mucoperiosteum is reflected up to the root ends of the tooth sockets, the external alveolar plate of bone is taken off, the diseased tissue is attended to under the eye; C. The bone is smoothed, leaving no jagged edges, the lingual, buccal, gingival mucosa trimmed and sutured with horse-hair; D. The sutures are removed in from four to five days.

In all essentials this operation is precisely the same as that which I have been describing and advocating ever since early in the year 1915 in:

*Pacific Dental Gazette*, March, 1915, May, 1915.

*Transactions of the Panama-Pacific Dental Congress*, August, September, 1915.

*California State Journal of Medicine*, November, 1915.

*Pacific Dental Gazette*, February, 1917.

AMERICAN JOURNAL OF SURGERY, August and September, 1917.

*Journal of the California State Dental Association*, November and December, 1917.

AMERICAN JOURNAL OF SURGERY, March, 1918.

*New York Medical Journal*, March 1918.

*The Journal of the National Dental Association*, June, 1918.

*Journal of the California State Dental Association*, June 1918.

AMERICAN JOURNAL OF SURGERY, February, 1919.

*Medical Review of Reviews*, February, 1919.

*The Dental Summary*, June, 1919, July, 1919.

*The Journal of the California State Dental Association*, July, 1919.

*California State Journal of Medicine*, September, 1919.

*The Southern Medical Journal*, September, 1919.

*Illinois Medical Journal*, August, 1920.

Sincerely,

Josef Novitzky, D.D.S.

### THE RELAXED EAR DRUM.

It is the universal opinion that so-called catarrhal deafness, better termed progressive deafness, is caused by a stenosed Eustachian tube with retraction of the ear drum due to insufficient air pressure. But if one examined carefully he would be surprised to find that in a number of cases the tube is patulous, in fact wider open than it ought to be and that instead of the ear-drum being retracted, it is relaxed. In such cases the deafness is due to a relaxed ear-drum which is unable to convey the sounds to the auditory nerve. —HAROLD HAYS in *The Medical Times*.

### THE TOLL OF AMERICAN NURSES IN THE WAR.

A sacred constellation of one hundred and eighty-four gold stars on the service flag of the American Red Cross Department of Nursing at Washington is the silent token of the supreme sacrifice made by that number of American nurses. The record is still incomplete and when this roll of honor is finally closed it is probable that the names of fully two hundred American women who have laid their lives on the altar of freedom will have been inscribed upon it.

Death came to American nurses in many forms. Striving against almost hopeless odds to check the epidemic of influenza that swept over the training camps in this country in 1918 nearly a hundred nurses themselves succumbed to the scourge. Many more were victims of the disease when it raged in the war zone. Ministering to the wounded in France other American nurses were killed by Hun ruthlessness in airplane raids.

But the American nurse who gave her life to the cause of Liberty did not die in vain. Into the shadowy beyond there went with her the prayers and murmurs of gratitude of those she succored. High military leaders gave their word of praise and appreciation for faithfulness that never faltered, while in homes saddened by the loss of the loved one there is imperishable pride.—*American Red Cross*.

# American Journal of Surgery

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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, MARCH, 1921.

### ACUTE ANATOMY

On the programme of a medical society in New York we find the printed title: "Paper—The Acute Pelvis". This is not surprising. If we can accustom ourselves to "acute abdomen" and "chronic appendix," why not also this delightfully descriptive expression! If another abortion of English is to be born into medical terminology, wherefrom better than the pelvis!

One of America's most renowned surgeons recently delivered an address describing certain experimental investigations that he had conducted, and their bearing on abdominal surgery. In the first two paragraphs of that address, just printed in a medical journal, this distinguished and brilliant surgeon speaks of "an interval appendix".... "an acute appendix,".... "acute and chronic suppurating gall-bladder".

Where is this to end? Otologists, emulating the noble example, talk of "chronic ears", and now gynecologists, not to be outdone in picturesqueness, have invented "the acute pelvis". May we not expect dentists to swing into line with "chronic teeth" and chiropodists with "acute toe-nails"?

A much revised medical dictionary will soon be needed, and we may expect to find in it definitions such as these:

**Eye, Chronic.** One that has lost its acuteness of vision.

**Exploratory.** Exploratory operation. (*Operation* is omitted for brevity only—never otherwise) Noun. May be singular (often very) or plural.

**Intestine, Chronic.** That portion of the digestive pathology that extends from the duodenitis to the fistula in ano, and produces cramps, temperature, diarrhea, catgut, and exploratories.

**Lung, Acute.** A pulmonary disease formerly called *pneumonia* (obsolete).

**Operation, acute.** One performed upon an acute abdomen (*q.v.*), usually after midnight.

**Pathology.** The disease removed from an organ at operation and located elsewhere at post-mortem. Formerly used to mean: The doctrine or consideration of diseases and of deviations from normal structure.

**Post-mortem.** Formerly an adjective, now a noun. See *autopsy*.

**Temperature.** Synonymous with *fever*, *pyrexia*.

**Tongue, chronic.** One that talks loosely; the antonym of *native tongue*.

**Urethra, chronic.** That portion of disease which forms a communication between the vesiculitis and the outer world, and gives passage to shreds, sounds and semen.

**Wasserman** (occasionally spelled **Wassermann**), **Babinski**, **von Graefe**, **Romberg**. Once distinguished physicians and investigators, now reactions and signs that indicate various pathologies.

**X-Ray.** Once used to designate the peculiar light rays discovered by Roentgen. Modern medical writers use the term to mean an *x-ray picture* or an *x-ray examination*, e.g., "an x-ray of the stomach showed marked pathology".

Shades of Oliver Wendell Holmes and Weir Mitchell, be not distressed. This new tribe of medical writers is not assaulting the language of "Elsie Venner", of "Hugh Wynne". They are inventing a new language of their own.

### HOW TO PREPARE A MEDICAL ARTICLE

Even with such a dictionary as we have above referred to, we fear the novice may feel that he is insufficiently equipped to write an article in this modern and popular style; and so we are publishing here a complete form that he may follow with entire confidence. It will be necessary to change only the dates, figures and a few other facts, to suit the author's needs or taste; but if he choose to vary it still more, the introductory instructions and explanatory notes will guide him in the right path.

If you feel the urge—or the need—to write a medical article, *don't—don't restrain yourself* merely because you have nothing new to say and hardly know how to say it! Facts and theories in medicine must be repeated again and again to drive them home. Remember that not all your colleagues read the same text-books that you do, and therefore it is your duty to disseminate their information. If, at the eleventh hour, you have hastily scratched off a "pot-boiler" as your contribution to a "symposium", don't waste it on the limited audience of a medical society—publish it!

If your contribution needs no illustrations, send some anyhow. If two or three are necessary send



six. Be liberal. It's a good idea to have these pictures *very* large—so large that the editor will print your article promptly to get them out of his way. Playfully enclose with these handsome wash drawings showing the skin incision about to be made, the skin incision half made and the skin incision completed, two or three very small, loose vest-pocket-camera photos. This is to test the editor's care of valuable property. Of course, he will not have any illustrations on hand but yours, therefore don't bother to write your name on them. If a weak x-ray print of the intestines battling with barium looks like an eruption of Vesuvius, held one way, and a military map, held another way, don't indicate which pleases you the more. Let the editor choose between top and bottom and then you may kick because he guessed wrong. You will recognize, if you stop to think about it (which you don't), that the legends for your illustrations must go to the printer to be set in type, while the pictures themselves go to the cut-maker to be reproduced. Therefore, *don't write these legends at the end of your article, where they belong, but paste each one tightly on the picture to which it refers.* This is to exercise the editor's ingenuity in removing them or his secretary's patience in copying them; and it is sure to make him think more of you. If you want the illustrations returned to you, don't say so, with your name and address on the back of each; let the publisher guess it by omitting to enclose return postage. If you make a sketch to illustrate what you are talking about, draw it right on your manuscript just where you want it to appear. The printer would not know what to do with it, but the editor can cut it out—in one way or another.

If possible, make up some charts or statistical tables on a dozen large sheets pasted edge to edge. To print them across a single page or even two pages, will be an interesting puzzle for which both editor and printer will be grateful; the tables are desirable to show the thoroughness of your research (into the literature), and their reproduction is no worry of yours. In these charts try to avoid any uniformity in typography, titles, abbreviations, capitalizations; write "minus" in one column and (—) in another, "percent." in one and (%) in another; and then make the spaces so small that the editor will not be able to take any liberties with them. Put in your manuscript "Insert Table I here". How can you foresee that the "here" will be an inch and a quarter from the bottom of the printed page?

Be sure to have your article written on a typewriter with broken characters and a much-worn ribbon. If the letters are clear and even, the editor will think that the machine is fairly new and he will jump to the conclusion that you are only a beginner. It will please him if the ink is a very pale blue or a vivid purple; the compositors also have a curious fondness for those tints. If your typewriter has a two-colored ribbon, you will not need to underscore headings and emphasized words; just write them in red ink. The printer, seeing red, will know exactly what is to appear in that color.

If you make copies of the article, keep the clearest one to read at the society meeting and send a blurred carbon copy to the journal. The purpose of that is to oblige the editor to read it slowly, which will the better impress him with its worth. Don't waste time reading over this carbon copy to supply omitted words or correct misspellings; let George editor do that. Use very thin, transparent sheets. This is not to save yourself postage but because, when the editor finds that the paper tears under his pencil, it will discourage him from making any unnecessary changes in your composition. For the same reason, never double-space your manuscript or leave a margin on either side. It is unimportant whether or not your pages are numbered after the sixtieth.

Avoid short sentences. Copy the style of the fourteen-line introductory sentences in newspaper articles, which begin with "The man whom the police suspect" and end near the middle of the column with "sailed yesterday on the Aquitania". In learning to write impressively involved sentences, forget the old rules that require subject, predicate and object. Indeed, it is best to ignore most of the rules of grammar, rhetoric and composition. Don't fetter your style. Get your thoughts across. Write, as you talk, free and easy, and thus convey to your readers the impression of spontaneity and sincerity. Don't waste thought on punctuation or paragraphing; at any rate, carefully avoid the appearance of having bothered with any uniformity in such trifling matters. Abbreviate words frequently, especially those in common medical usage; this gives the needed stamp of easy familiarity with the subjects and, too, abbreviations always look well in print. Do not, however, abbreviate the same word all the time or always in the same way; you must do nothing that would appear to be by system. Capitalize words here and there indifferently; this will make an ornamental relief to typographic monotony and attract the eye of the casual reader.

If you use headings and sub-headings underscore them for CAPITALS and for *italics* indiscriminately. This may annoy a too precise editor but, if it gets by him, it will show your readers that you have individuality. Similarly, if you use letters and numbers to indicate divisions and subdivisions, mix them up freely; make it evident that you are above trifles.

Spelling is entirely a matter of individual preference; let the editor see that you have ideas of your own. Spell proper names as they sound to you; the way their owners' spell them is their affair, not yours.

Don't refer to yourself as "I"—at least, not systematically; it fastens your responsibility too clearly. Call yourself "the writer" and "the author"; that makes one wonder whether you mean yourself or someone else you have just quoted, and it is important that you give your readers something to think about. "We" and "our" are also good substitutes for the immodest "I" and "my"; thus, when you say "at the hospital it is our routine..." you artfully suggest, without asserting, that the rest of the staff is as guilty as you are. The rules have not yet been sharply



defined in the new system, however, and the best practice at present is to say "the writer" and "the author" most of the time, sprinkling in here and there a few "I's and editorial "We"s.

There are certain words and expressions that belong in every medical article. Be sure to use them. These are: "cito, tuto et jucunde", "fons et origo", "pari passu", "marked", "throws light", "presented", "examination revealed", "symptom-complex", "interesting and instructive", "significant observation", "points out", "unexplored fields". (There is room in almost every article to scatter a few small "fields") When reporting a case refer frequently to "patient," but never write "the patient died"; say "ceased" or "exitus lethalis". On the other hand, don't be pedantic—if you want to come into this school of modernized medical English. You must not write "fenestra" (plural, "fenestrae"), but "fenestrum" (plural, "fenestra"); you are not in Rome so you don't have to say what the Romans would have said. Therefore also say "this data", instead of "these data". Say: "nauseous" when you mean "nauseated"; "looked like he was going" instead of "looked as though he were going"; and "since two years" rather than "since two years ago". If you are describing a case seen in 1910 nevertheless say "for the past two years" instead of "for the two years preceding". Use "that" and "which" alternately, "will" and "shall" indiscriminately. Say "same", when you mean "it"; the effect is more pleasing.

Embellish your article with references. If you wish, you may add to it a bibliography taken from a recent paper on the same subject. If that is not convenient you may, on the other hand, simply append the names of a few text-books without indicating what parts of them are concerned. Either way is acceptable, under the rules. If you quote or refer to a few publications, gather these titles at the end of the manuscript and label them sententiously "bibliography", not merely "references". Don't bother to read these publications in the original, nor to verify the accuracy of the references themselves, or of their dates, or of the authors' names. Especially avoid any uniformity in arranging these titles. Abbreviate the names of journals in as many different ways as you can. Give only the volume number, not the date; the reader can discover in a library what year the article was published. References to articles in weekly journals, however, should be simply by the year and the page number; anyone that wants to, can find out for himself whether it was in the first or second volume of that year. Don't spend ten cents to buy the little pamphlet on *The Bibliographic Style of the Journal of the A. M. A.*; you might be tempted to follow its scheme of abbreviations of journal titles. Establish your own style, or, better yet, avoid all style.

Select the title of your paper with great care. You might head it *Diphtheria* (one *h* is quite enough for this word and for *ophthalmoscope*) or *The Chronic Abdomen*, but such titles are too precise. Don't let your audience know too soon what you are talking

about; exercise reserve, keep 'em in suspense. It is better, therefore, to decide on such a title as *An Interesting Case*; that will defy classification in the *Index Medicus* and give you security in the feeling that you will not be quoted too widely. If, in the course of your paper, you mean to describe a new sign, reaction or apparatus, don't mention it in the title or as a subtitle, for then, too, it would be indexed, and you might be embarrassed soon to find it referred to by others—a liberty which, of course, you resent.

Your name should be followed by your collegiate degrees, also by your various hospital titles and medical society affiliations. It is a good idea to omit the least important of each of these and write in its place: *etc.* Since your name belongs under the title on the first page of your manuscript, write it modestly on the last page. When the editor discovers who it was that favored him with so interesting and instructive a contribution, he will not mind the slight effort of transposing your name and identifying labels. Don't, however, leave a space as though you expected him to do this; it will be just as easy for him to paste an extension on your first sheet. You will wish to tell, in a foot-note, where your paper first saw the light of night, for example, *\*Read at the first Annual meeting of the Alumni Association of the Montgomery Worthington Sniffem Memorial Hospital for Umbilical Deformities and Diseases of the Sternum, Sniffemtown, Pennsylvkota, Apr. 1-'20.* This, too, belongs on your first page, but you may put it on the last as though it were a trifling after-thought.

Having mastered all these new, but simple, rules you are now ready to put the subjoined *model* and two text-books on the desk before you and proceed with your composition. But here we must detain you for a final word of advice. Don't make the mistake of merely saying what you have to say, stripped of all inconsequential details and unnecessary verbiage. Don't write tersely, concisely, and strictly to the point; that would be crude and brusque, and your article would be scorned as too brief to be worth reading. Your facts should not be thus nakedly exposed; they must be protected, surrounded, embellished, buttressed and supported. Don't start off abruptly, and don't stop when you have said all that you need to say. Lead up to your subject very gradually, insidiously. A very good and quite original introduction is the historical retrospect, with just a suggestion (here be cautious) of prophecy. This supplies an approach from a broad background, and incidentally displays your acquaintance with the history of your art. Thus:

*In the proud Annals of Medical history—or, Among Medicina's great accomplishments in the alleviation of suffering, the triumphs of Abdominal Surgery stand forth [or you may say stand first] as a brilliant page of human endeavor. The introduction of Antisepsis and then of Asepsis revolutionized surgery and made it possible for the eager surgeon boldly to go into the abdomen and searching its depths, and feel confident of early discharge from the hospital. In those early days. . . [here give a pen picture*



of Ephraim MacDowell operating upon Mrs. Crawford in the wilderness of Kentucky or, if you do not wish to go back quite so far, say] when Willard Parker drained the appendix abscess by simple incision, appendicitis as such was not recognized. Then refer to Reginald Fitz and McBurney, Murphy, Fowler, etc., leading your hearers step by step to the climax: and today the pathology and treatment of acute appendix is a finished chapter—a field of purely surgical activity which even our medical confreres no longer dispute. But the Surgeon did not stop with the conquest of the right lower quadrant, intestinal pathology has also yielded to his technical research and today the more difficult field of the upper abdomen is no longer a *noli me tangere* to the expert surgeon, the pancreas, the stomach, duodenum, spleen and gall-bladder are also yielding to his knife. *Pari passu* with the development of abdominal technique the laboratory and the x-ray have advanced so that with their aid the surgeon now approaches cases with a large % of positive diagnosis. Look back thirty years to the beginnings of modern appendix work and when you think of all that is being accomplished it will not be long before the surgeon will be able to recognize and classify the *fons et origo* of all abdominal pathologies and promptly to remove them *cito, tuto et jucunde*. But we are still some distance from that distant goal. In spite of the wonderful advances in this field of medicine there remains several unexplored fields in which we have only made a beginning. It is not possible for me to consider them all within the limits of this paper and I will only call your attention to one field upon, which much light is needed to be thrown. I refer to those obscure and baffling cases of right-sided pathology in which pains persist even after the removal of a chronic appendix. Here is a field that invites the combined and earnest study of the Internist, the Surgeon, the Pathologist, the serologist and the X-Ray man. ["X-ray man", "eye man", "ear man"—like "old-clothes man"—give a pleasing touch of friendly familiarity.]

It is now time for a couple of references: Gehlsteiner, as quoted by Boedleston and Woerz (*Ganzgebluet für Augenheilkunde und Margenkrankheiten*, CXLI, 606) says [don't bother to verify what Gehlsteiner said, nor even what Boedleston and Woerz said he said; you can get facts enough for your purpose from a garbled abstract that says Boedleston and Woerz said Gehlsteiner said:] he observed in four fatal cases of right-sided pathology that no symptoms returned after removing gallbladders which were apparently normal grossly upon exploratory. Smith (*Journal of Experimental Mortality*, 5-'19) reports a brilliant series of experimental observations upon the variations in the respiratory rates of guinea-pigs deprived of cabbage leaves, and he points out that an increase in the metabolism rate above 6.3% reduces the H-ion concentration in the tissues, which causes a reduction in the CO<sub>2</sub> tension in the blood, followed by a measurable increase in its cholesterin content. He also made the significant observation that in such guinea-pigs the bile can be

made to precipitate by the passage through it of a weak galvanic current, after boiling for five minutes. The writer believes that this may have a bearing on gall-bladder pathologies.

Now you are ready for your case:

The following case is presented, not because it is of any significance but because it was my first operation in private practice. Cross that out and begin over again: The following case is presented not because it is conclusive in itself but in the hope that it will arouse discussion which will throw further light on this obscure field. On Feb. 9-1920 the writer was called in consultation [not necessary to underscore "in consultation"] to see... or On Feby 9 '20 this case presented himself at my office, [Formerly a case was a condition, not an individual; but this is changed in the new medical dictionary. Remember, patients do not come to a doctor's office, they "present themselves"—often that is all they do present] with the following history—

Mr. A. J., male, a young man of 21. Occupation:—plumber. [In this line you drive home the sex of the individual so clearly that very little doubt remains. If you merely said the patient was "a man of 21" instead of "a young man of 21" there might linger in the minds of some of your audience the suspicion that his symptoms may have been due to senile changes; and if you had written simply "plumber", instead of "occupation, plumber" it might be thought that plumbing was merely his week-end diversion and not a life passion.]

FAM. HISTORY—Father died in infancy, mother died in Ireland. 1 b. and 1 s. a. and w. Paternal aunt has epilepsy, hemiplegia, incontinence of urine and club-feet but is otherwise well. Maternal Grandmother living and well. She began to menstruate at 14, always regular, etc., etc.

Previous Hist.: Had mumps, measles and malaria. Habits,—good, never drank before July 1919. Being a plumber he got very little muscular exercise. Denies G., S., and several other letters.

Now you know that the above details have no bearing on your case but your readers don't know it—yet, so give it all to them "for discussion".

PRESENT HISTY; Since three years patient has had pains on right side of his abdomen coming at intervals of few days to several weeks and lasting a few minutes up to several hours. No relation to meals. [The patient and his grandmother dine together alone.] No vomiting but often is nauseous and feels like he is going to vomit. Pains sometimes in rt. iliac region, sometimes they run around to right kidney, sometimes they come around his naval or are referred to the R.U.Q. Two and a half yrs. ago he was operated upon for an interval appendix and felt well after that for a few weeks. Then the pains recurred again. Never jaundiced. Appetite good; always very constipated. Takes physics a good deal. No urinary or pulmonary sympts.

Status Praesens—He had no temperature, pulse 78, r. 24. Physical Examination revealed:—Here set down in great detail the report of your complete ex-



amination from scalp to toes, with proper phraseology, such as "percussion elicited" and "rectal showed", including

*Abdomen*—On inspection the abdomen was not distended. A four-inch scar is revealed over the McBurney. On palpation there was no rigidity but there is tenderness on pressure in the R.L.Q. In the R.U.Q. deep pressure under the costal arch elicited marked tenderness. Liver edge not felt.

The urine showed: clear, ac., amber, sp. gr, 1020, no alb., no sugar, micr. negative. Blood examinations shows—4,560,000 r. b. c.

7,200 w. b. c.  
polys 68%,  
etc.

I diagnosed a right-sided pathology, nature to be determined, and advised patient's removal to the Montgomery Worthington Sniffem Memorial for further observation and study.

On Admission 2-10-20 patient had no temperature and no pain, but his expression was anxious, pulse 96. Here repeat a complete physical examination, including mention of such reflexes, etc., as were not tested "when the case presented himself"; e. g.,

He had no Stekweg or Brudjinsky,  
No Kernig, Gordon or Bebinsky

Culture from the tonsils showed pure culture ["culture showed culture" and "functional tests of kidney function" may sound a bit awkward to you, but that is the way to write according to the new rules] of strept. Virodans. Vaccines were made to treat this focal infection. Wasserman negative. Spinal Wasserman-neg. Globulin, cell content and Colloidal gold normal.

Test Meal showed . . . . . put these figures in company front, the blood count figures having been tabulated in column formation.

Ewald showed . . . . .

Rehfuss . . . . .

*G. I. X-Rays*—Here describe the shape and outline of the stomach, its peristalsis, the picture after one hour, after six hours, after twenty-four hours; and send a full set of these roentgenograms to the journal publisher, to prove to your readers that they "revealed no definite abnormality" in the "G. I. tract"

*G-U. X-Rays: Negative.*

Insert here another urinary report, and another blood examination record, adding

blood cholesterin . . . . . 0.2%

No further signs were elicited on repeated thorough physicals but patient complained of feeling sore all over his abdomen. I decided to do an exploratory and remove whatever pathology presented. [Use that last sentence without any change; it's a gem.]

*Operation, 2-13-20, G-O and ether.* I made a long right rectus incision. . . . . Describe in detail: your audience will be as much interested in how you got into the belly as in how you escaped from it. On opening the peritoneum there was revealed adhesion of the omentum to the abdominal wall and to the caput colli. This pathology was dealt with by separating the omentum. Intestines looked normal and in their

proper place. Spleen normal to palpation. Stomach, pylorus and duodenum found in the upper abdomen, and negative to inspection and palpation. Liver of normal size and color. The gall-bladder presented from beneath edge of liver. Its surface was glistening and of normal color. No stones felt in g.b. or ducts. Gallbladder partly filled with fluid. The appendix having been already removed and no ulcer found in stomach or duodenum I decided the pathology was in the gall-bladder and that the proper procedure [improved spelling, to be noted also in several other common and medical words used in this model] was to do an ectomy. Here describe in detail the removal of the gall-bladder. A tube drain with two fenestra was inserted. Abdominal wall closed with layer sutures of chrom. gut, Silk-wormgut in skin Sterile dressing applied. Pat. put to bed. [You want no misgiving in the mind of any critic that after a laparotomy at the Montgomery W. S.M. Hospital you allow a patient to walk to bed and with wound uncovered.] Time of operation 2 hours, fifty minutes. [Let no one think you sacrifice thoroughness to heedless speed.] Patient was in some shock, for which we gave him strychn. sulph one-thirtieth and Adrenalene M.X. After two hours I had to open him up again to tie the cystic which the ligature on it had slipped off. Blood Transfusion was also done, 500 C.C. Patient vomited persistently for three days and developed Pneumonia at the right base. There was also some troublesome supuration of the wound for the first two weeks, and a paralysis of the right arm from hanging over the edge of the table which did not last long. On the eighth day there was noted a phlebitis in the left saphenus but same is now subsiding. Otherwise patient's convalescence was entirely uneventful.

Patient's post-operative bloods and urines showed:  
[Three pages of these will be enough.]

The temperature curve is shown on this chart:  
Paste it to the manuscript here.

*Path.* Report of the gallbladder revealed submucous hemorrhages. Since the hospital pathologist is present at the meeting he can describe the findings to you better than we can.

Disch. from Hosp. March 10, 1920.

Since operation patient has had much pain in region of the wound but he is sure same is not the same as his old pains which have not returned again since the gallbladder was taken out. [As you read your report at the meeting the patient, fully clothed, sits beside you in speechless admiration. At this juncture you turn to him with an air that disarms any suspicion of coaching and ask: *Is that right, Mr. Jay?* He slowly nods his head obliquely. Then you say: *Since the case shows only the usual scar I shall not trouble him to undress.* You shake hands with him, express your thanks that he came out on such a stormy night, and dismiss him, without, however, making the fatal mistake of giving him his carfare in the presence of the society. The chairman will not have the temerity to tell you that since you did not show anything on your patient your contribution to



the programme belonged, not at the beginning, under "Demonstration of Patients", but at the end, under "Reports of Cases"]

### SUMMARY.

*To summarize—A young man of 21 with negative Wasserman and good general health has right-side pains for 3 years, continuing even after removal of an interval appendix. All signs and tests negative except a positive Murphy could be elicited and increase of cholesterinemia 0.02%. On Exploratory no pathology except adherent omentum to caput colli. Cholecistectomy 6 weeks ago and no return of symptoms.*

You are wrong if you think that this summary suitably terminates your interesting and instructive contribution. It should be finished off gracefully with "Conclusions"; this will sound very good, indeed, when you read your paper, and it will attract somebody's attention when you publish it. So you continue thus:

*Conclusions:—In conclusion would say that*

*A. Right-sided pains in the abdomen persisting after removal of a chronic appendix is a broad field for further study.*

*b—That there are probably several pathologies that will have to be considered and worked out.*

*C, I believe that if we study our cases carefully that Chronic gall-bladders account for some of these cases.*

*D: Gross normal findings on inspection of gall-bladders at exploratories is not sufficient evidence that they are not the cause.*

*e in the absence of other pathologies such gall-bladders should be removed.*

*I wish to thank Dr. Littlefellow for kindly referring this interesting case to me, Dr. Crookstob, our X-ray man, for his excellent G.I. X-rays, and Dr. O'Topsie, the hospital pathologist for his pain-staking and thorough laboratory work in this case.*

Below this write your address (office hours may be omitted), and return the typewriter to its owner; the job is finished, and in a manner that leaves nothing (more) to be desired!

Again we warn you not to re-read your composition; alterations will spoil its freshness. Enclose it at once with a note to the editor of The Medical Speculum suggesting the importance to his readers of publishing it in the next issue. Don't give him a chance to reject it; write a second note a week later asking him when it will appear and expressing your surprise that you have not yet received proofs. If he should return it with thanks for the privilege of having read so interesting and instructive an article and regret that because he has so much material on hand, etc., you can see that he thinks it will make a big hit. Therefore send it to another editor, and another, until you find one who is willing to displace other acceptances to give yours the early publication its importance deserves.

When you receive the proof-sheets, do not read and return them promptly, but put them in your desk for a week; let it be evident that you are a busy man. Meanwhile don't bother to learn the rudiments of

proof-reading; that is not at all necessary; just cross out the words you don't recognize as yours and write others over them. The chief purpose in sending proofs to you is to afford you the opportunity to insert in your article a lot of things you learned at the medical meeting. Your paper was probably too short in the first place, so add to it freely; the publishers don't mind large bills for "author's changes" and the editor will have only the warmest feelings towards you for having upset his space calculations.

Order a thousand reprints with covers. When these arrive keep a small pile of them on your office table where no patient can possibly see them, and mail the rest to your friends and enemies in the profession. Let them know you are up and doing even if it is not quite clear what you are up to or doing. It will cost you several dollars, but you'll have the satisfaction of accumulating some handsomely engraved cards of thanks for "your interesting and instructive article on....." (space usually left blank).

## Surgical Suggestions

It should be borne in mind that sebaceous cysts of the scalp occasionally undergo cancerous degeneration. It is, therefore, important to remove "wens", and important also to submit all of them, upon removal, to at least a gross examination. If any part of the contents is suspicious, examine it microscopically. If carcinoma is found, the patient should be treated by x-rays, or, preferably, radium as soon as the wound is healed.

Be wary of the diagnosis "chronic appendicitis" as an explanation of persistent right-sided pain (even if there is some right iliac tenderness), or of gastric symptoms, unless there has been at least one acute attack! Most of such cases are no better after appendicectomy.

An epigastric hernia may be the sole cause of gastric symptoms simulating gastric ulcer, etc. When operating upon the hernia in such cases, however, it is wise to examine the upper abdominal viscera also. Cholelithiasis or a peptic ulcer may be found.

Gastro-enterostomy is often a curative operation in cases of gastric or duodenal ulcer when the pylorus is more or less completely occluded. If the pylorus is quite patent gastro-enterostomy gives no, or only transitory, relief unless the ulcer or the ulcer-bearing segment of the stomach is resected.



# Progress in Surgery

Selections from Recent Literature

H. Lyons Hunt, L. R. C. S., Abstract Editor

**Squamous-Cell Epithelioma of the Skin.** ALBERT COMPTON BROTHERS, Rochester, Minn., *Annals of Surgery*, February, 1921.

From a study of 256 squamous-celled epitheliomas of the skin Broders draws many conclusions, among them the following:

The terms "skin cancer" and "cancerous degeneration" should be discontinued.

Cancer is a regenerative-destructive process, resulting in the majority of instances from the interaction of anabolic and katabolic process.

In most cases malignant neoplasia probably follows the chronic excessive destruction of differentiated cells.

As a rule, the more marked the differentiation in a squamous-cell epithelioma, the lower is the degree of malignancy.

Pearly bodies and large flat squamous cells with small nuclei are not cancer. Cancer is regenerative or undifferentiated cells.

In the series studied squamous-cell epithelioma of the skin occurred more often in males than in females; in the proportion of 4 to 1. It occurred in patients past middle life; their average age was fifty-nine years.

The site of the cancer was preceded by a mole, wart, pimple, scab, ulcer, leukoplakia, crack, wen, blister, or lump in 51.17 per cent. of the cases.

There was a history of injury in 23.82 per cent. of the cases; burns represented 24.59 per cent. of the injuries, and x-ray burns represented 20 per cent. of the burns.

Seventy-eight per cent. of all the lesions occurred above the clavicle.

Twenty-eight of the patients were treated with acid, paste or plaster, etc., before they entered the clinic.

Twenty-six per cent. of the patients were operated on before they entered the clinic.

Of the 22.03 per cent. of the cases in which the regional lymph nodes or salivary glands were removed, metastasis was demonstrated in 61.53 per cent. The cervical lymph nodes were involved in 31.25 per cent., submaxillary lymph nodes in 28.12 per cent., the parotid lymph nodes in 25 per cent., the parotid salivary gland in 25 per cent., and the axillary and inguinal lymph nodes each in 15.62 per cent.

Fifty-one per cent. of the patients operated upon and traced are dead. Eighty-two and thirty-five hundredths per cent. of the living patients report having been free from the disease on an average of seven years.

Of the patients operated upon who died, 65.51 per cent. died of epithelioma.

The total poor results were 40 per cent. in patients who were previously treated with pastes, plasters, and so forth; and 30 per cent. in the others.

No patient with cervical lymph nodes or more than one group of any lymph nodes involved has been reported living.

All the patients reported dead who had metastasis died of epithelioma.

Sixty per cent. of the patients operated on in whom no metastasis was demonstrated are living, all with good results, and 40 per cent. are dead; over sixty-six per cent. of the patients reported dead who did not have metastasis died of epithelioma; fifty-four and seventy-six hundredths per cent. of the patients reported dead in whom no regional lymph nodes or salivary glands were removed, died of epithelioma.

The total good results for the patients with metastasis are 6.66 per cent.; for those without metastasis, 77.77 per cent.; and for those in whom no regional lymph nodes or salivary glands were removed, 66.33 per cent.

The average duration of the lesion in the patients with metastasis was two years; in those without metastasis, five years; and in those in whom no regional lymph nodes or salivary glands were removed, four years.

In his study Broders divided the lesions into four grades, according to the proportions of differentiated and indifferentiated epithelium. Those with a large percentage of differentiated epithelium were least malignant and gave the best results; the converse was also true.

**The Diagnosis and Treatment of Hydrocephalus Due to Occlusions of the Foramina of Magendie and Luschka.** WALTER E. DANDY, Baltimore, *Surgery, Gynecology and Obstetrics*, February, 1921.

Every case of hydrocephalus has a specific cause which can and should be located during life. He cites a group of cases caused by closure of the foramina of Luschka and Magendie. After discussing the anatomy and pathology of the foramina, the treatment of their occlusion and the production of a new foramen of Magendie at operation, Dandy concludes:

1. Blocking of the foramina of Luschka and Magendie invariably produces hydrocephalus. Patency of one of the three foramina prevents the development of hydrocephalus, provided the subarachnoid space is normal.

2. A group of cases is presented with occlusion of these foramina and with hydrocephalus resulting therefrom.

3. Undoubtedly, the disease occurring in adult life, follows an inflammatory process which may or may not have been clinically evident. Probably, failure of the foramina to develop accounts for the hydrocephalus in many cases which are recognized soon after birth; in other infants an intra-uterine or postnatal inflammation is the cause.

4. Although the general results of the occlusion are the same in every case, there are marked local anatomical differences due to the extent of the inflammatory process and the time of its development.

5. There are no clinical features which permit one to make an absolute diagnosis of occlusion of the foramina of Magendie and Luschka. In every instance, both in adults and infants, the diagnosis of hydrocephalus is possible; the exact site and the character of the obstruction causing the hydrocephalus can be determined by ventriculography and by phenolsuphonephthalein test.

6. The lesion can always be found at operation.

7. An operative treatment is presented. Two adult cases have apparently been cured by the procedure, which attacks the cause directly.

**Rotation-Dislocation of the Astragalus.** ROBERT OLLERENSHAW, *British Medical Journal*, January 29, 1921.

Dislocation of the astragalus alone is not a very common accident. The usual displacement is forwards—a condition which often results in a compound dislocation. A more uncommon displacement is backwards. Dislocation of the bone by rotation in its bed is rare, and when it does occur it is not possible to effect a reduction by manipulation. In this form of dislocation the astragalus is frequently detached from all its ligaments. Open operation is necessary, and removal of the astragalus has been the general procedure in the recorded cases. Stimson, in his book refers to seven cases. He insists that the description should include only those cases in which the astragalus has undergone rotation round a vertical or an antero-posterior axis, but still remains mainly within the tibio-fibular mortise. Barwell recommends primary removal of the astragalus in all cases of rotation-dislocation in which "certain and sufficient, but not too persevering, attempts at reduction" have failed.

In Ollerenshaw's case, while walking with the right foot well advanced a heavy piece of timber fell from a height and struck the back of the left heel. There was an obvious dislocation of the astragalus, the upper articular surface being palpable below the skin on the outer aspect of the dorsum of the foot. There was also a fracture of the fibula two inches above the tip of the malleolus. X-ray examination showed the dislocation to be a rotation of 90° round the vertical axis.

Manipulation was entirely unsuccessful. A curved incision was made from a point one and a half inches above and behind the outer malleolus curving across the prominence of the astragalus to the mid-line of the foot. The upper and outer surfaces of the astragalus were exposed lying imme-



diately under the skin, and the tendon of the peroneus tertius, almost completely frayed through, was found crossing the wound. This tendon was retracted inwards, and it was then found that the astragalus was completely free from all its attachments, the posterior surface pointing directly outwards and the head inwards. By forcing the foot into an exaggerated varus position and turning the bone it was possible to replace it. The foot was then everted, and the torn dorsal ligaments repaired and the peroneus tertius tendon sutured. The fibula fracture was positioned, the wound closed, and splinted on a metal shoe with a rectangular foot piece.

Gentle effleurage was commenced a fortnight later with active flexion and extension of the ankle under supervision to ensure that no inversion of the foot should occur. In the intervals of treatment the foot was retained in the splint. Six weeks after operation there was very useful movement. Weight-bearing was not permitted until three months had elapsed. Since that time the man has walked comfortably.

#### Cysts and Fistulae of the Thyroglossal Duct. P. K. GILMAN, San Francisco, *Surgery, Gynecology and Obstetrics*, February, 1921.

Discussing the embryology, anatomy and pathology of thyroglossal duct, cysts and fistulae Gilman cites ten cases, giving their diagnosis and treatment, and concludes:

1. Lesions due to the persistence of a portion of the thyroglossal duct are not rare and must be considered when attempting a differential diagnosis of abnormalities occurring along the course taken by the thyroid "anlage" from the base of the tongue to the region of the thyroid isthmus.

2. Thyroglossal lesions occur in the mid-line of the tongue or neck.

3. Median cervical sinuses occur singly, are never congenital as is the case in branchial cleft conditions, which moreover are lateral in their position, though the median lesions may appear at any time after birth.

4. Median cervical sinus is always preceded by swelling which ruptures or is opened by the surgeon under mistaken diagnosis, and which never closes permanently. Mucus is discharged unless it becomes purulent through infection.

5. Cysts of this structure show certain points of election and their contents vary somewhat according to their age and the predominance of certain elements in their walls.

6. Thyroglossal lesions are more common in women than in men and in the first twenty years of life.

#### Spontaneous and Operative Cure of Cirrhosis of Liver; Report of Illustrative Cases. DAVID RIESMAN, Philadelphia. *Journal of the A. M. A.* January 29, 1921.

Riesman reports a case of cirrhosis of the liver in which there was marked ascites with general enlargement of the veins of the abdomen and a very typical caput medusae, as well as edema of the legs. Tapping was resorted to repeatedly. At each tapping, except the last one, from  $3\frac{1}{2}$  to  $4\frac{1}{2}$  gallons of straw colored fluid were removed. Despite the tapping, the edema of the legs steadily increased until the limbs became of such enormous size that they could not be lifted or moved in the slightest degree. The scrotum was also greatly swollen. After the thirty-sixth tapping, about ten months after the first tapping, Riesman detected over the abdomen, particularly in the region of the liver and spleen, friction, appreciable both to touch and to the ear. Over this area of friction there was also considerable tenderness. The abdomen did not fill up again. Not only was there no return of ascites, but all the edema of the hugely swollen legs and of the scrotum disappeared. The man was able to be up and about, and even left the hospital. At present there is no ascites; the venous distention and the caput medusae have disappeared. Riesman suggests that, as indicated by the extensive friction, pain and tenderness, a fibrinous peritonitis followed the last tapping. The adhesions resulting from this peritonitis constituted a spontaneous Talma operation and sufficed to establish an adequate collateral circulation. In two other cases reported a cure was effected by the Talma operation.

#### Some Surgical Aspects of Asphyxia. EVARTS A. GRAHAM, St. Louis, Mo., *Annals of Surgery*, February, 1921.

By asphyxia in this article is meant not only an interference with the intake of air into the lungs, but also any disturbance in the free interchange of oxygen and carbon dioxide in the tissues and any disturbance of oxidative processes which results in the formation of abnormal amounts of products of incomplete oxidation.

Asphyxial conditions may therefore be produced in any of the following ways: (1) An interference with the intake of air, (2) an interference with the power of the blood to carry oxygen or to remove carbon dioxide, (3) an interference with the circulation of the blood, and (4) a disturbance of the power of the tissues to utilize oxygen. All of these factors are of interest to the surgeon, and he may encounter all of them even in the same patient.

Interference with the intake of air is the result of not only obstructions of the upper air-passages but also of pulmonary disturbances which give rise to a diminished alveolar surface. These latter disturbances are due both to changes within the lungs, such as inflammatory exudates, and to abnormal pressures outside the lungs which limit their normal expansion. The principal agents which restrict the expansion of the lungs by pressure, are air and fluid.

The disturbances within the thorax which are caused by abnormal changes of intrapleural pressure are discussed in detail from the standpoint of new experimental work, as a result of which it seems evident that the previous, commonly accepted ideas are incorrect.

From the standpoint of pressure relationships the normal thorax may be regarded practically as one cavity instead of two. Any change of pressure in one pleural cavity is accompanied by practically an equal change in the other, so that an equilibrium of pressure exists at all times throughout the whole thorax.

The prevalent conceptions of pneumothorax are erroneous in that they are based on the assumption that when an opening is made into the chest one lung is collapsed and the other maintains respiration. This assumption implies that the mediastinum constitutes a rigid partition between the two pleural cavities. On the contrary, the mediastinum in the normal thorax is so mobile that any increase of pressure in one pleural cavity pushes it over into the opposite one so that both lungs are compressed practically equally. If, on the other hand, the mediastinum has been made rigid by induration as a result of long-standing inflammation, or if it has become fixed by adhesions, then a pleural opening on one side will not produce the same pressure changes in both pleural cavities.

The maximum opening into a pleural cavity which is compatible with life depends upon a definite relationship which exists between the amount of air entering the lungs and the amount entering the pleural opening. The maximum opening compatible with life may be approximately determined for the normal chest by a mathematical expression. It is found that an average normal man should be able to withstand for a short time an opening of about 64.8 sq. cm. (10 square inches); one with a "vital capacity" greater than the average will be able to withstand a larger opening. There is harmony, therefore, between these results and the finding at the front that men were able to maintain respiration with gaping thoracic wounds which seemed surprisingly large.

A double open pneumothorax in a normal chest is more dangerous to life than a unilateral open pneumothorax merely because usually the combined areas of the two openings (and therefore the amount of air admitted into the pleural cavities) is greater than a single opening on one side is likely to be. Theoretically and experimentally effects of practically the same severity result in the case of one or more openings into the pleural cavity as follow the creation of a double pneumothorax, provided that in each case the combined areas of the various openings are equal.

The bearing of these results and deductions upon both the treatment of acute empyema and upon thoracic surgery in general is obvious. Whenever the amount of air taken into the lungs is limited by the presence of an active pneumonia,



with plugging of both air channels and alveoli, whenever there is an excessive demand for air, whenever there is a sufficient weakening of the respiratory muscles to impair compensation, or, in short, whenever there is a marked reduction in the "vital capacity," the size of a pleural opening compatible with life becomes smaller; and if any or all of the above factors are present in sufficient intensity, even a very small opening into the pleural cavity will produce death from asphyxia. Since all of these factors are likely to be present to a high degree during the early stage of an empyema of the streptococcus type, early operation with the establishment of an open pneumothorax carries with it an unwarrantable danger. Either a method of repeated aspirations or one of closed drainage is indicated until after the above dangerous factors have disappeared.

Interference with the ability of the blood to carry oxygen or to remove carbon dioxide is of interest to surgeons chiefly in connection with anemia, both acute and chronic, and perhaps rarely in poisonings of the type of carbon monoxide poisoning.

Interference with the circulation of the blood is of surgical importance not only locally in connection with the ligation or destruction of an artery, but also in heart disease, in shock, and in pneumothorax.

An inability on the part of the tissues to utilize oxygen is seen especially in narcosis with the common general anesthetic agents and also in intoxications with acids, cyanides, etc.

The effects of disturbances of tissue respiration are both anatomical and physiological. The former consist, in general, of the syndrome of edema, fat infiltration, hemorrhages, and necrosis. The physiological disturbances comprise the phenomenon of so-called "acidosis," changes in the respiration, glycosuria, etc. The importance of an impaired kidney function as a factor in the production of an "acidosis" is emphasized and discussed.

The applications of these ideas to various definite surgical conditions are discussed.

**Roentgen Ray Therapy in Hyperthyroidism.** WALTER C. BARKER, Philadelphia. *N. Y. Medical Journal*, February, 12, 1921.

Before using the roentgen ray as a therapeutic means, a roentgen examination should be made of the mediastinal region, to determine the presence of a submerged thyroid or hyperplasia of the thymus. Examination should be made to determine the cause of the hyperthyroidism, and when possible this should be remedied. Full doses of high penetrating roentgen ray should be used and the proper interval between treatments allowed, so as to note the effect before repeating the dose. Other endocrine glands should be irradiated when they are hyperactive. The reduction of the size of the thyroid for cosmetic purposes, for the relief of pressure or for removal of tumors, whether benign or malignant, is a problem for the surgeon and should never be attempted by roentgen therapy; the use of the roentgen ray in the treatment of the thyroid is only to inhibit the cell action in hyperthyroidism. It will here take the place of surgery with results which are as good and without scar and the dangers attending an operation.

**Regional Anesthesia.** GASTON L. LABAT, Rochester, Minn., *Annals of Surgery*, February, 1921.

Nerve blocking may be accomplished by four methods, the judicious combination of which meets the purposes of any operation:

1. Blocking the nerve terminals in the immediate vicinity or around the operative area.
2. Blocking the nerves at any point from the spine or skull foramina to the area they supply. The nerves are more accessible in the superficial layers in the immediate vicinity of fixed landmarks. When the anesthetic solution is injected close to the spine, the method constitutes paravertebral conduction anesthesia, the Laeven method.
3. Blocking the roots within the spine, but outside the dura mater; called the extradural, epidural or sacral method.
4. Blocking the roots within the dura; known as the intradural or spinal analgesia.

## Book Reviews

**Orthopedic and Reconstruction Surgery, Industrial and Civilian.** By FRED H. ALBEE, A.B., M.D., Sc.D., F.A.C.S., Professor and Director of Orthopedic Surgery, N. Y. Post-Graduate Medical School, and the University of Vermont; Chief Surgeon, U. S. Army General Hospital No. 3, etc., etc. Royal octavo; 1138 pages; 804 illustrations, many in colors. Philadelphia and London: W. B. SAUNDERS Co., 1919.

It is rather a long cry from such familiar text-books of orthopedic surgery as those, for example, of Bradford and Lovett and of Whitman, to the massive, elaborate and richly illustrated treatise of Albee, which includes within its scope pretty much the entire range of surgery of the bones and joints. From the smaller text-books mentioned the student may acquire information concerning the pathology and symptomatology of orthopedic diseases and deformities, and the general principles of treatment, especially of treatment by corrective or supportive appliances. But they do not give the reader, as Albee's work also does, a complete exposition of the operative relief and operative restoration of all the skeletal diseases and deformities.

The smaller text-books are representative of the orthopedic surgery of the older generation; Albee's is representative of the younger generation. It marks the dividing line between them, and it points the way to the specialists that are to come. There is no reason why the general surgeon should yield to them the surgery of the bones and joints; but there is no reason why they should not also occupy it. All that Albee includes in this splendid work may properly fall within the sphere of an orthopedist, and although he entitles his work "Orthopedic and Reconstruction Surgery," he might with entire propriety have called it simply "Orthopedic Surgery". Probably he enlarged the title to indicate that he was calling his colleagues into fields that they well might share with the general surgeon; or perhaps it was because, during the war, reconstructive surgery was a labor which orthopedic and general surgeons shared impartially. Such reconstructive surgery, however, as deals with plastic operations on the soft parts, and on the peripheral nerves, is not included in this work (except, *very briefly*, in the chapter on Military and Industrial Reconstruction Surgery).

This treatise is based on a wide study of the literature, and the references are very numerous. (There is a bibliography at the end of each chapter). Here and there, recent articles of value, or the latest article by the authors quoted, were overlooked. Included with all this is a description of the author's many original methods and operations. These, including his bone saw motor, have been published in various articles and, some of them, in his book "Bone Graft Surgery" (Saunders, 1915). In this new treatise he gives a thorough exposition of the principles and technics of his bone inlay operations, and of the employment of his motor, admirably illustrated—as is the entire book. He describes also his recently devised motor bone clamp—an apparatus for open reduction adaptable to his motor; and his fracture table, an improvement upon that of Hawley. Included, too, are some reconstructive operations devised while he was in charge of the service at U. S. A. General Hospital No. 3, at Colonia, N. J.

The non-operative treatment of fractures is not dealt with, except of the hip, the tarsus and the carpal scaphoid. There is much information, however, concerning the reduction of fractures, and a chapter on plaster of Paris technic. Arthroplasties and arthrodesis, operations for osteomyelitis, skeletal tuberculosis, tendon transplantations, congenital and acquired deformities—these and all the other topics commonly described in text-books on orthopedics are dealt with in detail. Very interesting is the chapter of 100 pages on *military and reconstruction surgery* covering some topics not previously presented and also illustrating the application of bone graft surgery to particular types of tissue loss.

Altogether, we regard this treatise as a valuable addition



to surgical literature and we warmly recommend it as an adequate, forward-looking and thoroughly modern exposition of orthopedic surgery.

**Chirurgie Reparatrice et Orthopedique.** Publie sous la Direction de E. JEANBRAU, P. NOVE-JOSSERAND, L. OMBREDANNE et P. DESFOSES (Secrétaire de la Rédaction.) *En deux Volumes.* Octavo; 1340 pages; 1040 figures. Paris: MASSON ET CIE, 1920.

This admirable work, which appeared soon after the treatise by Albee under the same title, is quite different in its contents. It is not concerned with those congenital deformities and tuberculous or otherwise infectious diseases of the bones and joints that we ordinarily include within the scope of orthopedic surgery; but it does deal, very extensively, with all those injuries, disorders and deformities that may be produced by external violence, requiring major surgical attention for immediate treatment or for subsequent repair. It is, indeed, a work on major traumatic surgery—of the head, face, neck, chest, abdomen (incompletely), spine and peripheral nerves, as well as of the bones, joints, muscles, tendons and vessels.

It is the first work of this kind to appear, in France, at any rate, and is the composite expression of the brilliant studies of French surgeons and neurologists during the war. It is, however, not merely an exposition of military surgery, nor was it planned as a review of that subject. It is intended, rather, as a treatise on modern traumatic surgery, as a guide in the management of major injuries in civil life—the accidents that occur in the mill and the factory, in building construction, in railroad wrecks, on shipboard or in the streets.

The two volumes are the work of 48 eminent authors, including the editors. We need but mention a few of the well-known names to indicate the authoritative character of this treatise—Lemaître (who wrote the introductory chapter on the treatment of wounds, describing the principles and technique of the methods he principally evolved and which are familiar to us under the generic term, "débridement"), Cuneo, Dujarier, Imbert, Lecène, Roux-Berger, Mme. Athanassio-Benisty.

The first volume deals with: new methods of wound treatment; the extraction of foreign bodies; the repair of skin, muscles, tendons, aponeuroses, bloodvessels, nerves, bones, joints; the affections of amputation stumps; orthopedic and prosthetic appliances; the complications—infectious and otherwise—of traumatisms. Following these general subjects, which occupy about 400 pages, it considers injuries to the head (cranio-cerebral, facial, orbital, mandibular—and their plastic and prosthetic restoration, the salivary structures and the mouth), the neck, (contractures, esophageal, laryngeal and tracheal wounds, etc.), the thorax, (wounds of the chest wall, intrathoracic projectiles), the spine and the cord, the abdomen (pseudo-hernia, intestinal fistula and artificial anus, urethral fistulae. Other abdominal and genital injuries are not considered!)

Volume two is devoted to the surgery of injuries, and of the results of injuries, to the extremities—as concern the individual joints, bones, nerves, amputation stumps, etc.

While the work is distinctively French it is written on broad lines and the methods of American, English and Italian surgeons are frequently referred to and illustrated.

**Surgery. Its Principles and Practice.** For Students and Practitioners. By ASTLEY PASTON COOPER ASHHURST, A.B., M.D., F.A.C.S., Associate in Surgery in the University of Pennsylvania; Surgeon to the Episcopal Hospital and to the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases; Colonel, Medical Reserve Corps, U. S. Army. *Second Edition.* Royal octavo; 1170 pages; 1129 illustrations; 14 color plates. Philadelphia and New York: LEA & FEBIGER, 1920.

It is today quite impossible to confine within the limits of a single volume—even though it were larger than this one—a comprehensive treatise on general surgery. A single-volume work can be but a text-book for students, a descrip-

tion of salient facts for the practitioner. To prepare such was, obviously, the purpose of Ashhurst, and, judged accordingly, he has produced an excellent work, presenting several admirable features. Among these the many fine original photographs and sketches deserve mention.

In this edition one finds much new matter or revisions in the sections on gunshot wounds, infected wounds, Carrel-Dakin treatment, compound fractures, shock, empyema thoracis, carcinoma of the tongue (including the description of the author's operation), infections of the hand, etc., and more than one hundred new illustrations, all of them excellent.

We found the text very interesting throughout. The author has the knack of condensing information and presenting important features clearly. To be sure, one may find—one is bound to find in such a work—things that may be criticised or disputed. Nor could one expect, perhaps, that all surgical diseases and affections would be referred to in such a text-book. Thus, there is no mention of trochanteric bursitis or of tuberculosis of that bursa. The brief description of subdeltoid bursitis is faulty in every particular—diagnosis, pathology, symptomatology and treatment—and quite ignores published facts. There is no x-ray picture of the fairly common subbursal lime deposits that often are found in this affection, and no reference to such an occurrence—although this common finding and other demonstrations quite dispose of Thomas' claim that in most of these cases of shoulder complaint ("peri-arthritis") the main lesions are in the axillary region of the joint, with which opinion Ashhurst expresses agreement.

It seems to us that the medical student reading the section on hyperthyroidism will have an exaggerated notion of the curability of the disease by surgery; but that is a criticism that can be made of many other works—medical as well as surgical.

The description of the varieties of abdominal herniae is excellent, and so is that of the technics of inguinal hernioplasty. Without confusing the student with too many variations it presents to him very clearly all the essentials, and the important details. We do not believe, as Ashhurst seems to do, that chromicized catgut is sufficiently reliable for inguinal hernioplasties; kangaroo tendon, not too coarse, seems to us a much more dependable material for these operations. Ashhurst prefers the inguinal to the femoral approach in operations for femoral hernia. In this many surgeons agree with him. The reviewer believes that the femoral route, in most cases, affords opportunity to do all that can be accomplished from above: it is simpler and does not open up the intact inguinal canal; the sutures can be placed in the same position from below as from above; and, since the peritoneum can easily be dragged down as far as one wishes to, the sac can be tied off so high that the stump disappears deeply in the abdominal cavity—and it is this supposed advantage of high ligation of the sac that is claimed as the chief merit of the inguinal operation.

This edition shows extensive and careful revision. The work is attractive as well as very readable and, for the most part, the text is reliable as well as up-to-date. Altogether, we regard it as a very acceptable text-book, and would place it among a very few to be recommended to American students and practitioners.

**Surgery.** A Text-Book by Various Authors. Edited by GEORGE E. GASK, C.M.G., D.S.O., F.R.C.S. (Eng.), Surgeon and Director of the Surgical Professorial Unit, St. Bartholomew's Hospital, and HAROLD M. WILSON, M.S., M.B., (Lond.), F.R.C.S., (Eng.), Surgeon, with Charge of Out-Patients, St. Bartholomew's Hospital. Royal Octavo; 1186 pages; 467 illustrations; 39 plates, 20 in color. London: J. & A. CHURCHILL, 1920.

In 1910 two of the authors of this work, Spencer and Gask, published a text-book of surgery as a continuation, a "tenth edition", of Walsham's well-known "Surgery". In a measure, this new product might be regarded as a continuation, or modernized edition, of Spencer and Gask's, not merely because of this element of common authorship but because all the fifteen other contributors (W. Girling Ball,



W. McAdam Eccles, Reginald C. Elmslie, Sir Charles Gordon-Watson, H. E. Griffiths, W. Douglas Harmer, R. Foster Moore, Sir D'Arcy Power, L. Bathe Rawling, J. E. H. Roberts, K. M. Walker, H. J. Waring, C. Ernest West, Herbert Williamson and Harold Wilson) are surgeons on the staff of the same hospital—St. Bartholomew's. Indeed, it was by this intimate association of the contributors that the editors expected to avoid the bad features of multiple authorship, viz., unevenness of merit and contradictory views. This, it seems to us, has been accomplished. The book contains some of the illustrations used in Spencer and Gask's and is of about the same size. In bulk, it is rather less than that of the last edition of DaCosta's *Surgery*, which contains about 400 more pages; but the English work is printed in somewhat finer type. Certainly it contains more descriptive matter than several other single-volume works on surgery. Much of this, however, is taken up by the surgery of the eye, the ear, and the female generative organs, and by gonorrhea—subjects to which many like works of American authorship give little or no space.

The text deals chiefly with pathology, symptomatology, diagnosis and modes of treatment. Operations are described but briefly; and this seems wise in a text-book of this character, for adequate exposition of operative procedures would require another volume. References are omitted altogether. They are not essential to the student, but they interest and stimulate him. Their inclusion also stimulates the authors of scientific books to accuracy and up-to-dateness.

In any single-volume work on general surgery, even one as bulky as this, there must be omissions, even omissions of rather important clinical data; and it can hardly be expected that authors and critics could agree upon where to draw the line in accomplishing the necessary condensation. The writer's interest in or special familiarity with certain subjects is bound to influence him; and, correspondingly, the reviewer might be tempted to criticize the failure to include or to elaborate those special topics in which he happens to be particularly interested or informed. It may be said, however, that the authors have, in this respect, followed the path of least resistance and have produced a text-book along well-established lines, and much more comprehensive than many similar works. It must be remembered, too, that the purpose of the editors was "to supplement, but not to supplant, teaching at the bedside and clinical lectures".

In any work on surgery, whether by one author or many, the critic may also find measures recommended that he believes to be undesirable or outworn. It is no severe stricture, therefore, to say that we have found some in this book. Thus, concerning appendicitis with abscess, it is advised that "in the case of a large localized abscess a simple incision should be made into the abscess cavity and a drainage tube inserted without making at the time any further search for the appendix". This is sage advice for the inexperienced operator, called upon to treat such a case in an emergency; and it is a wise thing for the experienced surgeon in those few cases where his judgment indicates it. But it is not the routine practice among experienced surgeons in America who, we believe, usually remove the appendix, even in the presence of a large abscess; and we incline to the belief that in competent hands the one-stage operation has a lower mortality as well as a much reduced period of hospitalization, and less likelihood of hernia. This must be, of course, largely a matter of opinion; and so, too, is the question of following the advice given to stitch the gall-bladder to the abdominal wall when performing cholecystostomy. We thought this procedure had been generally abandoned as unnecessary and, since it interferes with the respiratory movement of the liver, quite undesirable. We think, too, that we would limit our choice of cholecystostomy, instead of cholecystectomy, much more than the author of this section (Gask), but this also is a matter in which surgeons have not quite agreed.

Altogether, this is a good text-book for the medical student, and a very useful one for the general practitioner. It is a worthy successor to Walsham's, from the pens of some of England's most celebrated surgeons.

**Die Chirurgie der Brustorgane.** VON FERDINAND SAUERBRUCH. Zugleich *Seichte Auflage* der "Technik der Thoraxchirurgie" von F. SAUERBRUCH und E. D. SCHUMACHER. *Erster Band:* Die Erkrankungen der Lunge, unter Mitarbeit von W. FELIX, L. SPENGLER, L. V. MURALT, E. STIERLIN, H. CHAOL. Large Octavo; 860 pages; 637 illustrations. Berlin: JULIUS SPRINGER, 1920.

Professor Sauerbruch has enlarged his original 90-page volume on the technique of thoracic surgery into an encyclopedic two-volume system of surgery of the chest. The first volume, before us, includes valuable chapters on the anatomy, physiology and radiography of the chest and lungs, as well as chapters on their pathology and surgical treatment. The illustrations and the mechanical appearance of the book are equal to the best of Germany's pre-war publications. There is an exceptionally full classified bibliography and a complete index.

Unfortunately, the work of American pioneers in this field has not been adequately considered. In the chapter on endoscopy, no mention is made of the distally illuminated tubes of Chevalier Jackson or of the remarkable endoscopic accomplishments of Jackson, Lynch, Lynah or Mosher and a host of others. No reference is made to Yankauer's endobronchial lavage of abscess cavities. Diphtheria is unmentioned although tracheo-bronchial diphtheria requires the most expert surgical handling as has been demonstrated by Lynah at the Willard Parker Hospital.

In the chapter on artificial pneumothorax, to which 104 pages are given, the valuable technique of W. Parry Morgan with differential manometers is neglected, nor is there allusion to the substitution of filtered air for nitrogen as recommended by Forlanini originally.

The chapter on operative treatment of pulmonary tuberculosis is especially full, including the Brauer-Friedrich operations as well as Sauerbruch's operation for incomplete pneumothorax. Other procedures described are pneumolysis, tamponade, fat transplantation and resection of the phrenic nerve. There is a brief but instructive chapter on tumors of the lung. There is an interesting chapter describing Trendelenburg's attack on embolism of the pulmonary artery. One of the cases operated by Schumacher in the author's clinic survived five days.

The technique of differential pressure is lauded but the remarkable work accomplished by Duval and other surgeons without its aid, apparently has been overlooked.

It would be very unfortunate if these remarks were to convey the impression that Sauerbruch's work is essentially lacking in completeness. There is too much merit in the book to permit that idea to remain by implication. The omissions are such as we hope will be corrected in a future edition, which its inherent worth will surely demand.

**The Treatment of Wounds of Lung and Pleura.** Based on a Study of the Mechanics and Physiology of the Thorax. Artificial Pneumothorax—Thoracentesis—Treatment of Empyema. By PROF. EUGENIO MORELLI, Assistant in the Medical Clinic of the Royal University of Pavia; Maggiore Medico, Field Hospital No. 79. Translated from the Italian by LINCOLN DAVIS, formerly Lieutenant-Colonel, M.C., U. S. Army and FREDERICK C. IRVING, formerly Major, M.C., U. S. Army. Octavo; 214 pages; illustrated. Boston: W. M. LEONARD, 1920.

Davis and Irving have performed for English-speaking surgeons and physicians a distinct service in preparing this excellent translation of Morelli's recent and important book. While they were attached to the A. E. F. in Italy they had the opportunity of observing some hundred of the cases treated by Major Morelli in Italian Field Hospital 79, which was under his direction and devoted exclusively to wounds of the lung and pleura, and they were convinced of "the far-reaching and beneficent effects of his artificial pneumothorax treatment in wounds of the lung". The reader will also be convinced, we believe, of the beneficence of his simple, original methods, not only by the logic of his discourse but by the array of his case records. The reviewer



was so fascinated by the book that he could not lay it down until he had read it through!

Morelli was assistant of Forlanini, who wrote a touching introduction to this work two days before his death, and who in 1882 introduced artificial pneumothorax in the treatment of phthisis—a method for the conception of which John B. Murphy also deserved credit, and which, though practiced regularly in Forlanini's clinics, was not recognized and accepted generally for over 30 years. Ten years ago Morelli published some of his adaptations of Forlanini's method to other intrapleural affections, and he had evidently conceived then its application to traumatic lesions, which the war gave him the opportunity to put to the test.

Just as Forlanini's and Morelli's methods (e. g. air replacement when emptying a pleural effusion) have not been learned and practiced by physicians generally, so, too, Morelli's methods in the management of wounds of the pleura and lung appear to be considerably in advance of the practices of other surgeons in the war.

We shall not review the physiological-mechanical principles, so clearly laid down by Morelli, upon which he based his methods, to whet our readers' desires for a more intimate acquaintance with the book, shall merely mention some of the accomplishments of his methods of treatment. He has so modified and so well described the technic of artificial pneumothorax that, using a simple apparatus with the precautions he lays down, the procedure becomes an easy one, free from danger. He shows that, in penetrating wounds, artificial pneumothorax arrests pulmonary hemorrhage by collapsing the lung, brings prompt relief of distress, facilitates closure and healing, and goes far to prevent adhesions. In cases of wounds of the lung, he evacuates the hemothorax, by needle, as promptly as possible and arrests further bleeding by immediate artificial pneumothorax, and thus reduced the number of cases of empyema development to less than two per cent.! In cases of contusion of the lung—where there is no hemothorax—artificial pneumothorax, by collapsing and immobilizing the lung, obviated the common development of broncho-pneumonia and pulmonary abscess. Because small amounts of blood remaining in the complementary spaces after thoracentesis for hemothorax form a nidus for bacterial growth (empyema) and produce fibrin deposits, he often washes out all this blood, after introducing the air and through the same apparatus.

The phenomena of what we have called "sucking wounds" of the chest are only in part, he believes, explicable by oscillation of the mediastinum. In part they are due to pleural reflexes—a sort of "pleural eclampsia". While he regards it as important that air should be allowed to enter the chest (pneumothorax) in pulmonary wounds, this entrance should not be tumultuous; an open wound in the chest wall should be plugged or otherwise closed as soon as possible—at the Field Hospital or even on the battlefield. For this purpose he devised a set of dumb bell shaped distensible rubber balloons, to be inserted and expanded in the wound. He describes their advantages over gauze tamponade and over sutures. They do not work well in large wounds and in these, too, Morelli believes that empyema is inevitable; and in all such cases he combines with, or soon adds to, his primary operation, a thoracotomy for drainage, even before pus appears. He does not believe, apparently, that missiles left in the lung are a source of later danger; and we judge that he does not advocate their removal, except perhaps, in the case of large, irregular ecclats with fragments of clothing. The nature of the lung lesion is a smaller factor than the nature of the wound in the chest wall. Missiles lodged in the pleural cavity are more dangerous, says Morelli, than those lodged in the lung. Concerning this phase of the subject, however, very little is said. Morelli shows that the rapid passage of a missile through the pleural space does not sufficiently contaminate it to cause its infection. That infection comes (from an open wound or) from the lung. Hence Morelli urges the importance of promptly closing the lung wound, not by suturing it as other surgeons did, but by artificial pneumothorax.

The adaptation of these methods to the evacuation of sérous

and purulent effusions, will interest the medical as well as the surgical practitioner. For empyemata Morelli employs a closed system of suction-drainage—using a tube passed through an hour-glass dilatable bag to close the wound—and can easily manipulate his apparatus to irrigate the cavity or to maintain positive or negative pressure within it, as indicated. With more or less similar closed drainage and suction systems we are familiar. Whether Morelli's method is on the whole better than, for example, sterilization by Carrell-Dakin technic it is probably hard to say.

Following 65 case reports is a "discussion of cases". In a series of 110 cases treated at the field hospital August to October 1917, there were but 5 deaths. "It is not the small number of deaths *per se*, but rather an examination into their causes and a study of the functional results of cured cases, which obligate a critical consideration" and in Morelli's opinion recognition of his method of treatment.

**Injuries of the Peripheral Nerves.** By HENRY S. SOUTAR, C.B.E., F.R.C.S. ENG., M. CH. OXON., MAJOR, EX-R.A.M.C., Assistant Surgeon and Director of the Surgical Unit, London Hospital; Late Senior Surgeon, British Red Cross Hospital, Netley; and Deputy Consulting Surgeon to the Southern Command; and EDWARD W. TWINING, M.R.C.S., L.R.C.P., Lond., Captain, EX-R.A.M.C., Medical Officer in Charge of Physical Treatment Department, Pensions Hospital, Netley; late Medical Officer in Charge of Physical Treatment Department, British Red Cross Hospital, Netley. Octavo; 152 pages; 30 illustrations. New York: WILLIAM WOOD AND COMPANY, 1920.

The war has provided us with a rich and steadily growing literature of peripheral nerve injuries—their various manifestations, concerning which a vast amount has been learned; and their treatment, in which certain principles have been definitely established, and some methods have been clearly proven to be unphysiological and ineffectual. This small and modest book has a useful place among volumes more pretentious and complete. It is not put out as an exhaustive discussion of the subject, nor even as a text-book. It is, rather, a very readable, simple statement of the salient facts concerning the symptomatology, tissue changes and processes of repair in injuries of motor, sensory and mixed nerves in general and of the more important nerves in particular; diagnostic procedures and analysis of findings; operative repair; and physical treatment. It is in no sense a discussion of the literature, but is based essentially on the war experience of the authors at the British Red Cross Hospital, Netley. As such, it might well have been expanded into a more comprehensive exposition of the symptomatology of peripheral nerve injuries and a more detailed description of operative and non-operative treatment. In its condensed form it is, however, an excellent introduction to a closer study of the subject and, as we have said, a well-conceived statement of the most important facts established by the experiences of the past few years.

Like others who have studied their results carefully, Soutar and Twining clearly indicate that the proper operation, whenever possible, for a divided or resected nerve is end-to-end suture. Even large gaps in a nerve can often be overcome by nerve-freeing and traction, by two-stage operations (preliminary suture of bulbous ends to effect stretching and later resection of the bulbous ends), by posture, and, if need be, by bone-shortening. Three other types of operation have produced good results in a smaller number of cases, but none of them is to be preferred to meticulous end-to-end suture. These are: the flap operation; insertion of free nerve grafts into the gap; and lateral implantation. In the latter operation (one or both ends of a divided nerve may be implanted into another nerve) it is essential to cut across those fibers of the sound nerve that are to be diverted into, or receive the down-growing axons from, the injured nerve. Merely tacking the end of a nerve to the side of another provides no means of regeneration. As a physiological basis for these operations of implantation or "anastomosis" the authors say "the operation can be carried out without any permanent injury to the contributory nerve. In any ordinary nerve, such as the median in the upper arm, one-



third of the fibers may be divided without any permanent loss of function. This is not true of the sciatic as a whole since it consists of two distinct portions, the internal and external popliteal, but it is true of each of these portions separately. A reservation must also be made regarding the part just above the point where a branch is given off...."

A nice problem that the surgeon may be called upon to decide is when and when not to resect a nerve thickened, or partly divided at the site of injury. The indications for resection in certain types of neuroma and scar infiltrations have not been definitely established. The authors do not refer to neuromata, but they briefly discuss the question of resecting partly divided, scar-invaded nerves. "Empirically, at least", they say, "it would appear that the hard scars should be resected and the soft scars left alone" and "if the scar is densely hard; if, above all, the upper end of the nerve shows evidence of bulb formation, resection is inevitable". They point out how much can be accomplished, when the latter condition does not exist, by freeing the nerve (external neurolysis) and protecting its mobility in a bed of muscle, or in a nourished flap of fat and fascia. Internal neurolysis, a tedious and delicate operation that has been much in vogue in Germany, they believe to be only occasionally indicated.

There is a chapter on "alternative methods" (tendon transplantation, joint ankylosis, artificial tendons and ligaments), and a brief one outlining some methods of treating causalgia.

**Studies in Neurology.** By HENRY HEAD, M.D., F.R.S., in conjunction with W. H. R. RIVERS, M.D., F.R.S., GORDON HOLMES, M.D., C.M.G., JAMES SHERREN, F.R.C.S., THEODORE THOMPSON, M.D., AND GEORGE RIDDOCH, M.D. *In Two Volumes.* Imperial Octavo; 832 pages; 182 illustrations. London: HENRY FROWDE; HODDER & STOUGHTON, 1920.

In these two volumes are reprinted those important papers, published in *Brain* from 1905 to 1918, inclusive, that established Head as the greatest living investigator of and authority on sensation. These papers are: The Afferent Nervous System from a New Aspect, by Head, Rivers and Sherren (1905); The Consequences of Injury to the Peripheral Nerves in Man, by the same authors (1905); A Human Experiment in Nerve Division, by Rivers and Head (1908); The Grouping of Afferent Impulses within the Spinal Cord, by Head and Thompson, (1906); The Automatic Bladder, Excessive Sweating and Some Other Reflex Conditions, in Gross Injuries of the Spinal Cord, by Head and Riddoch (1917); Sensory Disturbances from Cerebral Lesions, by Head and Holmes (1911-12); Sensation and the Cerebral Cortex, by Head (1918). From these papers were omitted only the description of Head's methods of testing sensation. This topic has been rewritten in a separate section of three chapters. There has been added a brief but interesting Epilogue, in which Head reviews these papers and points out the theoretical bearing of a work that "is essentially a study in function by clinical methods in man". There is also an Appendix in which he discusses the more important criticisms of his teachings, viz., those published by Trotter and Davies, by Boring and by von Frey. A table of contents and a good index complete the transformation of these separate studies into a book. Neurologists and neuro-surgeons will welcome the reproduction in this form.

**Clinical Ophthalmology for the General Practitioner.**

By A. MAITLAND RAMSEY, M.D., Fellow of the Royal Faculty of Physicians and Surgeons, Glasgow; Lecturer on Ophthalmology, University of Glasgow; Ophthalmic Surgeon, Glasgow Royal Infirmary; Author of "Atlas of External Diseases of the Eye," "Eye Injuries and their Treatment," "Diathesis and Ocular Diseases," etc. With a foreword by SIR JAMES MACKENZIE, M.D., F.R.S., Royal octavo; 500 pages; illustrated. London: HENRY FROWDE; HODDER AND STOUGHTON, 1920.

This is not a treatise on Ophthalmology for the specialist. It is, as its title indicates, a work for the general practitioner, a clinical guide indicating the recognition of ocular and palpebral lesions, in their developmental as well as in their advanced states, and their treatment. In therapeutic meas-

ures the author indicates those that can be conducted by the practitioner and those that should be referred to the ophthalmic surgeon. Thus the chapter on cataract is devoted to "the duty of the general practitioner towards a patient suffering from cataract—before, during and after the operation", and but a page is given to a general description of the operation itself (Smith's Indian method). The accidents and complications of the operation and the post-operative care, as these concern the family physician are, however, discussed. There is a useful appendix of *therapeutic notes and formulae* and a *glossary* of ophthalmologic terms.

The work is strictly clinical and altogether practical—a sensible and useful book for the practitioner. The illustrations are for the most part photographic plates, many of them in color.

**Tropical Ophthalmology.** By ROBERT HENRY ELLIOTT, M.D., B.S., (Lond.) Sc.D. (Edin.) F.R.C.S., (Eng.) Lieutenant-Colonel I.M.S. (Retired); Late Superintendent of the Government Ophthalmic Hospital, Madras, and Professor of Ophthalmology, Medical College, Madras; Honorary Fellow and Gold Medallist of the American Academy of Ophthalmology and Otolaryngology; Lecturer in Ophthalmology, London School of Tropical Medicine; Ophthalmic Surgeon to the Seamen's Hospital Society, and to the Hospital for Tropical Diseases, Endsleigh Gardens, London. Octavo; 525 pages; 117 illustrations and 7 plates. London: HENRY FROWDE; HODDER AND STOUGHTON, 1920.

The publication, from time to time, in our periodical medical literature, of observations on various oriental ophthalmic disorders by American surgeons engaged in Near East Relief, has aroused our interest in those many affections of the eye that are more or less peculiar to and common in various parts of Asia and Asia Minor. In this work the author has gathered together in book form, probably for the first time, the most important facts of tropical ophthalmology, based on his own experience in India and on the published observations of others. These references are, purposely, not complete, but were carefully selected from the accumulated literature; and the book represents many years of preparation. We have found its perusal extremely interesting, not merely from the purely scientific standpoint, but also for the insight it gives into all those factors—superstition, ignorance, crowding, dust, heat, and others, that make eye disorders prevalent in the orient, and into those curious methods common to the unqualified native practitioners in medicinal and surgical treatment. (e.g., "couching" cataracts.)

Tropical eye diseases are matters of no small concern to the western nations. An understanding of their causes and the conditions that affect their treatment is essential to their intelligent management by missionaries from those nations. Elliot's book, therefore, quite aside from its value as merely interesting reading matter, is a useful contribution to civilizing efforts, and it certainly will, as its author hopes, "stimulate the young worker to play a man's part in the far-off lands, to which opportunity has led, or necessity has driven him".

**Urologische Operationslehre.** Herausgegeben von PROF. DR. VOELCKER, in Halle und PROF. DR. WOSSIDLO, in Berlin. Bearbeitet von Privatozent DR. V. BLUM in Wien, Geh. Rat. PROF. DR. F. COLMERS, Direktor des Landkrankenhauses in Colburg, Privadozent DR. L. KIELLEUTHNER in Muenchen, Privadozent DR. O. KNEISE in Halle a.S.-Geh. Med.-Rat Prof. Dr. HERMANN KUMMELL in Hamburg, Dr. OSCAR ORTH, I. Ass.-Arzt der chirurgischen Universitätsklinik in Halle, a.S., Privadozent DR. R. PASCHKIS in Wien, PROF. DR. F. VOELCKER, Direktor der chirurgischen Universitätsklinik in Halle, Dr. E. WOSSIDLO in Berlin, PROF. DR. H. WOSSIDLO in Berlin, PROF. DR. O. ZUCKERKANDL in Wien. Imperial Octavo; 581 pages; 445 illustrations, some of them colored, and 3 colored plates. Leipzig: GEORG THIEME, 1921.

This large and important work, though published in a single volume, is divided into two parts. The first part, edited by Profs. Voelcker and Wassidlo, was almost completed when the outbreak of the war in 1914 made necessary



the postponement of its appearance until 1917. It covers the following subjects: Asepsis, Antisepsis, general, local and paravertebral Anesthesia, by Prof. Colmers; Instrumentation of the Bladder and Urethra, by Kielleuthner; Endoscopic Urethral Operations, by Erich Wossidlo; Open Operations on the Urethra, also by Erich Wossidlo; Operations upon the Prostate, by Prof. H. Wossidlo; Operations upon the Seminal Vesicles, by Prof. Voelcker; Endovesical Operations, by Blum.

The editing of the second part, now finished, and incorporated with the first, was completed by Prof. Voelcker alone, Prof. Wossidlo having died. It includes: Open Bladder Operations, by Voelcker; Operations upon the Kidney and Kidney Pelvis, by Kuemmell; Operations upon the Ureter, by Kuemmell, Zuckerkandl and Paschkis; Operations upon the Urethra, Penis and Scrotum, by Orth; Urologic Operations in the Female, by Kneise.

The work is not concerned with symptomatology, pathology or diagnosis. It deals strictly with the operative surgery of the urinary tract, of which it is a very thorough discussion. It is international in scope, presenting the operative procedures of American, English, French and Italian, as well as German surgeons. It is excellently printed and profusely illustrated, many of the drawings being in color. A bibliography is appended to each subject.

A complete treatise on operative urologic surgery, it is an important book for the general surgeon and for the surgeon specializing in this field.

**The Roentgen Diagnosis of Diseases of the Alimentary Canal.** By RUSSEL D. CARMAN, M.D., Head of Section on Roentgenology, Division of Medicine, Mayo Clinic; Professor of Roentgenology (Mayo Foundation), Graduate School of Medicine, University of Minnesota. *Second Edition.* Octavo; 676 pages; 626 illustrations. Philadelphia and London: W. B. SAUNDERS COMPANY, 1920.

In roentgen ray diagnosis the most significant advances of recent years has been in its application to abdominal—and especially gastro-intestinal diseases—in which field the author has been an active contributor to its accomplishments. He was the first in America to gather together the scattered published data of gastro-intestinal roentgen diagnosis for publication in a single volume; and his book, based not only on his own vast experience at the Mayo Clinic, but also on the accumulated literature of the world, at once won a well-merited recognition.

This, the second, edition shows considerable revision. About 100 pages and over 100 new roentgenograms and many very instructive case reports, with their roentgen pictures, have been incorporated. There are also two new chapters: an excellent one on *hour-glass stomach*; and the other, on *pneumoperitoneal diagnosis*, in which the author abstracts the literature of this subject but indicates no experience of his own.

In his case reports Carman records candidly several instances in which the operative findings disproved the roentgen diagnosis. In his interpretation of the significance of many findings, e. g., delayed stomach emptying, hypermotility, incisure, Carman is far more critical and cautious than many roentgenologists once were or, indeed, than some now are. As illustrative of his critique, we quote his sensible and sardonic comment on roentgen diagnosis of appendicitis: "On the whole, the value of the roentgen signs of appendicitis appears to depend not only upon the intensity of the examiner's endeavor, but also, to some extent, upon the degree of his enthusiasm. Inasmuch as few normal appendices have been found by surgeons or pathologists, the diagnosis of appendicitis upon any grounds whatever is not at all hazardous...." We wish this would soak into those immature roentgenologists who so often and so glibly terminate their long, neatly typewritten, blue-paper-covered and ribbon-tied reports with their cock-sure verdict: "Chronic Appendix"!

What make this work an excellent volume for study and for reference are not merely its completeness, its richness of excellent roentgenograms, and its abundance of bibliographic references, but also its presentation of the subject, its balance, and its "critique".

**A Text-Book of the Practice of Medicine.** By JAMES M. ANDERS, M.D., PH.D., LL.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania. *Fourteenth Edition*, with the assistance of JOHN H. MUSSER, JR., M.D., Associate in Medicine, University of Pennsylvania. Royal octavo; 1284 pages; illustrated. Philadelphia and London: W. B. SAUNDERS COMPANY, 1920.

Anders' "Practice" has been before the profession almost a quarter-century, during which time it has shared popularity with Osler's as a text-book for medical students and practitioners. In this, its fourteenth edition, it therefore needs no introduction nor extended review.

The work has been thoroughly revised by the author and by Dr. John H. Musser, Jr., and examination of its text and bibliographic references indicate that it has been brought quite up-to-date. Thus, the sections on the heart are quite representative of recent teachings, and there is a new section on that affection, not new but especially studied during the war, *disordered action of the heart*. Other new matter included is: *streptococcic pneumonia, trench nephritis, chronic aortitis, epidemic encephalitis, botulism, wood alcohol poisoning, bronchial spirochetosis, interstitial emphysema and oxycephaly*.

The section on influenza has been re-written, and among many sections that have been much revised are those on *diabetes, scurvy, pernicious anemia, Banti's disease, pellagra, focal infections, yellow fever, measles, tuberculosis, asthma, hay fever, etc.* The discussion of *typhus fever* is quite up-to-date, including reference to the monograph of Danielopolu (1919). Anders appears to accept Plotz' bacillus as the responsible organism, but he properly adds that Rocha-Lima denies this, and he refers to the rickettsia prowazeki, the organism apparently identical with those found by Ricketts, Prowazek and others.

We know of no up-to-date text book of medicine better than Anders'.

**The American Year Book of Anesthesia and Analgesia.** F. H. McMECHAN, A.M., M.D., Editor. Quarto; 483 pages; illustrated. New York: SURGERY PUBLISHING COMPANY, 1921.

**American Red Cross Work Among the French People.** By FISHER AMES, JR. Duodecimo; 178 pages; illustrated. New York: THE MACMILLAN COMPANY, 1921.

This is the last of a series of books published under the auspices of the Red Cross to tell the American people about the vast things their dollars accomplished in Europe, through that organization, during the World War. The books previously printed are: *The American Red Cross in the War, The Red Cross in Italy, With the Doughboy in France, and The Passing Legions*.

None of these books is a dry-as-dust presentation of statistics, a tedious recital of numbers of hospitals, ambulances, dressings, shirts, comfort-kits or cigarettes. These figures are published elsewhere. They are all, instead, and so is this one of Ames, interesting narratives of conditions and accomplishments. They are books that Americans will enjoy reading, that will make them proud of America and of its great organization of mercy and relief, and proud to be, or to become, members of the American Red Cross.

**Stammering, Its Cause and Cure.** By G. ROBINSON SKILLMAN. Duodecimo; 78 pages; illustrated. Baltimore: KUEHN BROS. & COMPANY, 1920.

A little book for stammerers by one who cured himself.

#### BOOKS RECEIVED.

**Dermatology, The Essentials of Cutaneous Medicine.** By WALTER JAMES HIGHMAN, M.D., Associate Professor of Dermatology, New York Post-Graduate Medical School and Hospital; Acting Associate Dermatologist, Mt. Sinai Hospital, New York; Adjunct Dermatologist, Lenox Hill Hospital, New York; Pathologist, Department of Dermatology, Vanderbilt Clinic, New York; etc. Octavo; 482 pages; illustrated. New York: THE MACMILLAN Co., 1921.



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## SOME FACTS REGARDING CANCER.\*

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The role of chronic irritation as a factor in the causation of cancer is becoming more important, and some of the evidence gradually being accumulated is interesting and curious.

The kangri basket of the Kashmir natives of Thibet is a rather famous chronic irritant. During the long winters, they carry a basket of warm charcoals in front of the abdomen, or place it between the thighs and knees. Fifty per cent. of carcinoma in these people is cancer of the skin of the abdomen and thighs. The betel-nut chewers of India likewise have an inordinate incidence of carcinoma of the mouth. They chew the nut constantly, often sleeping with it in their cheek. In China, the men eat first, and the women always eat later, when the food is cold. Carcinoma of the esophagus and mouth is common among men in China, but not nearly so common among women. Natives who do not cook their food have far less incidence of cancer of the upper alimentary tract than civilized communities have. W. J. Mayo has often commented on the heat of ingested foods as a cause of upper alimentary cancer<sup>1</sup>. Hot porridge is generally ingested at 163°, rice at 168°, and hot liquids in general range from 120° to 170°.

Lip cancer developing so frequently in those who smoke a short pipe, and cancer of the stomach following gastric ulcer, are common instances of cancer developing upon a bed of long continued irritation.

Bertillon<sup>2</sup> once divided France into two squares, one centering about Paris, the zone of greatest alcohol and meat consumption, and the other bordering on the Mediterranean, where these habits are much less in evidence. The upper square had two to four times the cancer incidence of the lower, and the increase was chiefly in cancer of the stomach and rectum.

Imperfect combustion of coal probably is a cancer irritant of some sort, for while coal miners have a low mortality, workers in gas works and coal heavers about boilers and engines have a relatively high

one, and English chimney sweeps had a cancer mortality five times that of normal<sup>3</sup>.

This last was due chiefly to cancer of the scrotum, attributable to the direct irritant action of the soot in caking up between the folds of the scrotal integument, for on the continent, where clothing precautions were taken, there was no such increase.

The rabbit is an animal normally very resistant to cancer. A Japanese pathologist has recently developed carcinoma in the ear of the rabbit by repeatedly painting the ear with coal tar.

Workers in coal tar and aniline industries are known to be frequently affected with keratoses, warts, and papilloma of the bladder, all of which often become malignant.

Dermatologists "see cancer in all sorts of processes of long-standing irritation," to quote Pusey<sup>4</sup>, and they, as a group, recognized the origin of cancer from an irritated focus long before surgeons or the profession generally did.

Cancer of the skin follows lupus erythematosus, lupus vulgaris, psoriasis, or develops in those whose skins have been exposed to light or heat over long periods of time. Malignant degeneration of the skin of the face is common, while on the extremities, except the dorsum of the hands, which are uncovered, it is the rarest of occurrences.

It is known that long continued ingestion of arsenic causes keratoses to appear on the hands, face, and feet, and these occasionally undergo malignant degeneration. Arsenic is a protoplasmic irritant. When it enters the horn cell it sensitizes it to light, so that an abnormal growth may take place after what would be an average sun exposure to a normal cell<sup>5</sup>.

Cancer never develops upon normal skin.<sup>6</sup> On the face or exposed portions, malignant degeneration follows nevi, keratoses, pigmented moles, etc. These rarely form cancers on the body or extremities. On these regions there must be a previous lesion of the skin of an inflammatory nature, and the important thing is that the inflammation has been chronic, over a period of months or years.

There has been no adequate explanation of the relative rarity of cancer of the skin of the body and extremities, as compared to cancer of the face. A reason may be that the continued sunlight irritation

\*Read before the Maimonides Medical Society, Detroit, October, 1920. Portions of this paper appeared as an editorial in *Modern Medicine*, October, 1920.



is sufficient to metamorphose an abnormal cell rest, such as a pigmented mole, if it be on the face, but if it be on the body, this long standing irritation being lacking, the mole never changes.

In this connection Udo Wile<sup>5</sup> has observed that he sees much more cancer of the skin in Ann Arbor, where the clinic draws chiefly from country districts than he did in New York, where the clinics draw from crowded tenements. In New York, there were but 2 cases of cancer of the skin in over 6,000 patients. In Ann Arbor, in a clinic one-sixth as large, there were 48 cases of carcinoma of the skin in the first year, and these were chiefly in farmers. Though cancer is rare in the extremities, as before stated, it follows chronic ulcers, sinuses, old gunshot wounds, sinuses of chronic osteomyelitis, scars of burns, chronic eczema, syphilitic ulcers, etc. All of these processes, if very slow in healing (months or years) are apt later to become the seat of malignant epithelial degeneration. Often these may be very rapidly growing.<sup>6</sup>

#### IS CANCER INCREASING?

Whether cancer is really increasing, or the apparent increase everywhere reported is due to improved diagnosis, difference in longevity, and improved registration is still an open question. Certain it is that every statistical survey reports an increased cancer mortality. From sixty-three deaths per hundred thousand population in 1900, to eighty-one deaths in 1915, or an increase of nearly thirty per cent, are the figures from the United States Registration Area statistics. These statistics cover roughly seventy-five per cent. of the population. During this same time the death rate from tuberculosis fell from 202 to 145 per 100,000<sup>7</sup>.

In New York City, the general death rate for 1919 fell 23% over that for 1918, but the recorded cancer deaths have increased 4%. Throughout the world, there are similar steady increases. Thus, from 1896 to 1910, while the United States cancer mortality increased eighteen per hundred thousand population, Ireland increased thirty per hundred thousand, Denmark eighteen, Germany thirteen, and Austria ten<sup>8</sup>.

But, to what extent can this apparent increase be ascribed to the increased longevity of the present day, and to the varying degrees of accuracy in diagnosis? Since the Civil War, fifteen years have been added to our normal expectation of life<sup>9</sup>. German vital statistics estimate a difference of twenty-five years in the length of the life of the Prussian of 1860 and of today. Dogs and cats, the only animals who in nature are allowed to live out their normal life expectancy in any great numbers, have a high frequency

of cancers,<sup>10</sup> even higher than that of man. Certainly all mortality statistics have to be corrected for the proportion of inhabitants reaching cancer age before inferences can be drawn.

How can increased incidence due to better diagnosis be measured? It is rather difficult, but there are certain pertinent facts. Carcinoma in some regions of the body is much more accessible to physical diagnosis than in others. If recognition being steadily increasing were responsible for the present day high mortality figures, the curves of the accessible organs might remain flat, while the curves of the inaccessible ones would steadily mount.

King and Newsolme, in 1893, first tested this proposition. At that time the municipal mortality statistics of Frankfort-am-Maine were the only ones where separate tabulations for each body organ had been kept, and they had been so compiled since 1860. Classifying tongue, mamma, uterus, and vagina as accessible, and the internal organs, chiefly alimentary tract, as inaccessible, they found the curve of the first group remaining flat, that of the second mounting steadily. Wilcox has recently brought this table up to the year 1913, and it shows the internal organ cancers, those less readily accessible to physical diagnosis, presenting a steady yearly rise over a period of fifty years, the other groups remaining flat all this time.<sup>11</sup>

Following King and Newsolme's original publication, English statistics were tabulated for separate organs. Analysis of these figures, chiefly by Bashford and Murray<sup>12, 13</sup> over two decades support the same argument. While cancer of the skin and of the uterus, both easily accessible to physical examination, showed no increase, alimentary cancer everywhere showed a rising curve. The male has much more cancer of the alimentary tract than the female; stated differently, 97% of male carcinomata are inaccessible, while only 63% of female cancers are inaccessible. All statistics show cancer increasing more rapidly in the male than in the female. Bashford thinks these differences are due to differences in the accessibility to physical examination. From London Hospital statistics, 1904-1909, classifying growths as accessible or inaccessible to physical examination, he estimated that 91% of the accessible growths were diagnosed, while only 62% of inaccessible ones were recognized at the time of death.

American cancer mortality statistics classified under organs primarily involved, are still not available, but there is a tabulation showing what proportion of cancers of each body location were diagnosed with reasonable certainty in one year, 1914 (that is, at the



time of death, the attending physician was not in doubt as to the diagnosis.) This shows an accessible group, comprising cancers of the breast, skin, tongue, lip, mouth, vagina, testes, uterus, larynx, and rectum presenting practically no diagnostic uncertainty at the time of death, while the inaccessible group range from cancer of the ovary and Fallopian tube with 15% of diagnoses uncertain, to carcinoma of the stomach with 72% uncertain.

Another factor Bashford and Murray hold responsible for the increased recognition of to-day is a gradually decreasing tendency to ascribe "failing vital functions in the aged as a cause of an obscure illness"<sup>12</sup> i. e., fewer deaths reported as old age, tumor, etc. While the curve of cancer mortality for the ages forty to fifty has been relatively stationary for some years, the reported mortality in the aged has been relatively increasing. As regards cancer mortality "England of to-day compares with England of several years ago as London of to-day compares with rural England of to-day."

There is other evidence showing that cancer mortality varies with the status of the medical practice of the community. In cities, cancer mortality is usually higher, but decreasing more slowly than in country districts, and that notwithstanding the larger proportion of aged persons with high cancer mortality in the country.

There is less cancer among negroes of the south than among whites, but the negro rate is increasing more rapidly. In eight large southern cities, cancer among negroes increased 92% from 1891 to 1914, while that of whites increased 73%.<sup>11</sup>

Wilcox believes these facts to be connected with the larger proportion, greater accessibility, and improved methods of city physicians.

#### SURGERY AND CANCER.

What has surgery done for cancer, and what hope of cure does it offer? Some writers are not optimistic. Whether or not surgery obtains a cure depends on two factors, first, whether distant metastases, often unrecognized, are present at the time of operation, and, second, incomplete surgical removal, or grafting or dissemination of carcinoma cells during the operation.

The body defence against carcinoma metastases is the formation of a connective tissue capsule. Carcinomatous emboli occur with great frequency, and are transplanted everywhere. The reason they do not form metastases oftener is because the connective tissue encapsulation is an immediate protection. This encapsulation of emboli takes place with great frequency about the small arteries of the lungs in carcinoma of the abdominal viscera. In bone, car-

cinomatous emboli lodge in the lacunae, act as osteoclasts, break down some of the bone, then this space is filled up with carcinoma. This mass is surrounded by connective tissue fibrils, and later a bony capsule is laid down about the irritating focus. Whether the body or the carcinoma triumphs depends a good deal upon the local immunity of the organ, "the metabolic affinity between the carcinoma cells and the cells of the particular organ." A carcinomatous embolus may remain encapsulated for years, and then suddenly, presumably because of some lowered resistance, it will burst forth into a metastasis. Here is an explanation of metastasis occurring years after operation. This varying degree of immunity has often been clinically commented upon. The late J. B. Murphy often spoke of the "rebelliousness of cancer when it occurs with obesity," and remarked that "the thin spare type has a tendency to the production of connective tissue, preventing the spread of malignant cells."<sup>14</sup> W. J. Mayo<sup>9</sup> observes that whereas all persons have a certain measure of immunity, some having sufficient to prevent their ever having cancer, in others there may be enough so that an incomplete operation will not be followed by recurrence. Grafting, dissemination of carcinoma cells, or incomplete removal at the time of operation are of course commonly known sources of recurrences. W. J. Mayo states that he has often been impressed by local grafting of carcinoma cells, such as recurrences at the site of skin suture holes only, or recurrence about a colostomy wound from a low sigmoid growth.

Once the regional lymph glands are involved, the outlook is altogether different, and incomplete removal, no matter how careful and skillful the dissection, is the rule. Carcinoma of the lip is one of the most favorable malignant tumors operated upon, as regards ultimate cure. When no glands are involved, various statistics show 70% to 80% cures. In a recent study of the material at the Mayo Clinic, Broders<sup>15</sup> shows that 76% of cancers of the lip without glandular involvement are still living. Of those having glandular metastases, only 17% are alive, and all of these had only one submaxillary lymph group involved. No case with two groups of glands involved, or with cervical glands involved has been reported living. Bevan<sup>16</sup> says that from his personal experience, he does not think he has ever cured a carcinoma of the breast with axillary metastasis.

To arrive at an estimate of just what surgery has done for cancer, Levin<sup>17</sup> compiled a table of the reported results from various surgeons and clinics. In one column, called high estimate, were placed those from the best operators, (Halsted, Mayo, Willy Meyer, etc.,) and in the second column, called low



estimate, were placed the reported results from other surgeons. The table is reproduced:

	High estimate per cent. of 5-year cures. (Halsted, Mayo, etc.)	Low estimate per cent. of 5-year cures. Other surgeons).
Bladder .....	30	6.8
Breast .....	38	16
Hand, face, neck.	83	30
Liver .....	None	None (Chiefly metastatic)
Mouth, tongue ..	20	13
Rectum .....	50	9
Stomach .....	25	3
Abdomen .....	12	4

If now, one would take the average operability as 50%—the surgeon refuses to operate upon 50% of the patients presenting themselves to him because of too advanced stage,—and then compare the average of the above cures with the cancer incidence taken from mortality figures, one would obtain an estimate of just how much cancer is cured surgically. Doing so, Levin<sup>17</sup> says that the best surgeons cure 15%, the average surgeon 4%. If all patients came to the surgeon in time, that is if the operability were 100%, the high estimate table would average only 30% of cures. At present, about 10% are cured.

But statistics like these are changing, and because of two factors:

(A). The limits of operability are widening. At the Mayo clinic<sup>9</sup> when 25% of carcinomas of the intestine and rectum were deemed operable, the operative mortality and per cent. of 5-year cures were greater than now. As more of the further advanced cases were operated upon, the operative mortality and per cent. of 5-year cures diminished, but instead of curing 13 in each 100 patients presenting themselves, they now cure 27.

(B). People are gradually seeking advice earlier, and more often than formerly before a precancerous condition has become malignant. At Johns Hopkins, Bloodgood<sup>18</sup> says that the incidence of benign tumors of the breast has risen from 32% to 59% of the total breast tumors operated upon, and the surgeon is nowadays called upon much more frequently than in former days to decide upon the nature of a borderline tumor.

Of these two factors, the second is much more potent and promising. Surgical technic has undergone advances recently, especially in carcinoma of the colon, and a few years earlier in gastric resections, but as a general rule operative removal of

malignant growths is about standardized. Very much improved methods of removing a given tumor are not to be expected.

The crux of the situation is early diagnosis, and education of the public to recognize dangerous early symptoms. In Germany campaigns have been waged by the state for many years, and today German surgeons operate upon cancer in a much earlier stage than do American surgeons. All the circulars of the propaganda campaigns of the American Society for the Control of Cancer have such titles as these: "Fear the beginning of cancer." "Cancer is curable by early operation." "Cancer—in the early treatment lies the hope of cure." "What you should know about cancer", etc.

It is to be hoped that these methods, analogous to those which produced such striking results in campaigns against tuberculosis, will have similar far-reaching effects in the control of cancer mortality.

2407 WOODWARD AVENUE.

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#### BLADDER CARCINOMA.

Resection of the bladder, with or without ureteral transplantation, is the only rational treatment for early and favorably situated carcinoma.

For malignant disease involving the neck of the bladder, total cystectomy, very exceptionally, may be performed.

In certain cases of carcinoma, unfavorably situated for resection or too far advanced for radical treatment, cystotomy followed by intensive fulguration, radium implantation and roentgen ray is on trial, with a promise to prolong life and possibly rarely to effect cure.—B. A. THOMAS in *The Journal A. M. A.*



## RADICAL CURE OF HEMORRHOIDS.

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and Hospital, Rectal Surgeon to the  
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*Preparation of the Patient.*—The patient is to be as carefully and thoroughly prepared for a hemorrhoid operation as for a laparotomy. If a cathartic is deemed necessary, an ounce of castor oil is given twenty-four hours before the operation, to sweep out septic and decomposing material from the intestines. This cathartic must be given long enough in advance of the operation to allow the patient to get rid of it, and for the increased peristalsis to subside. If the patient already has been taking a cathartic daily, the physic, in some instances, may advantageously be omitted, to avoid exhausting him. Most patients do not eat much previous to the operation, still some consider it a last chance for several days, and consequently, unless warned, will gorge themselves. Hence, I request the patient to abstain from meat, vegetables containing much cellulose and gas-forming foods, and to subsist for the day before the operation on broths, cooked pulpy vegetables, and other readily absorbable foods. The patient enters the hospital on the evening before the operation, and if restless is given 20 grains of bromides, in order to insure sound sleep for the night. That same evening he is given an enema of physiologic salt solution, and then is left undisturbed. Early on the morning of the operation, the perianal region is shaved and cleansed, and a sterile dressing is applied. Three hours before the operation the patient is given a one-pint enema. One hour before the operation he is given a cup of soup or else coffee and toast, for it is better not to operate when his stomach is empty. He is given a hypodermatic injection containing morphine 1-4 grain, hyoscine 1-100 grain, and atropine 1-150 grain; after which all visitors must leave the room. This injection quiets him and obviates psychic trauma.

*The Operation in Detail.*—My operative technic is the same whether performed under local or general anesthesia.

If a local anesthesia is decided upon, a little extra detail is necessary in preparing the patient.

The table should be covered with a thick pad and the patient should be provided with a pillow to help make him comfortable. Always remember that he is not anesthetized, and every sound and touch is appreciated by him. He should, therefore, be handled as little and as carefully as possible, not tied or

strapped in any way, the left lateral prone position with the hips raised (the proctologic position) is satisfactory for the surgeon, as well as the most comfortable for the patient, and prevents the sacro-iliac strain, which so often is caused by the lithotomy position.

I use one-half of one per cent solution of apothesine or procaine for infiltration of the skin, thus permitting a liberal amount to be used without danger of toxicity, as apothesine is but one-seventh as toxic as cocaine. Quinine-urea solution is not used for the skin, because its injection is painful. The success of a local anesthetic depends upon a careful and thorough infiltration of the whole field. I use a 26 gauge needle. A 30 cc. syringe is filled with warmed anesthetic solution. The skin in the posterior raphé, one inch back of the anal margin, where it is less sensitive, is touched with phenol on a swab, and after waiting a few minutes, the skin is picked up between the thumb and forefinger of the left hand, and the needle is introduced at the cauterized spot. A few drops of apothesine solution injected here causes a wheal to arise, and after waiting a few moments, the needle is advanced, and another wheal is made, while the needle is carried forward just under the skin at a distance of one-half inch from the anal opening. When the needle has been advanced its full length on one side, it is retracted to the posterior commissure but not withdrawn from the skin, and the infiltration is carried up on the other side of the anus. When the full depth of the needle has been reached on both sides of the anus it is withdrawn and inserted at the most anterior wheal just made, and the infiltration is continued to the anterior commissure and around on the opposite side until the wheals meet those previously produced. In this way the whole anal opening is anesthetized, while the needle is always kept one-half inch out from the edge of the mucous membrane. This procedure blocks the inferior sphincteric nerves. Wait ten minutes for anesthesia to be complete, and then introduce the left index finger into the rectum above the external sphincter, hook the finger over the muscle and by slight traction draw it down and steady it while the needle, passed through the anesthetized skin, is carried into the sphincter muscle and 20 minims of apothesine solution are deposited in its substance. This deep injection is made in four places, one on either side of the commissures, one-half inch out at the entrance of the lesser sphincter nerves. The index finger within the anus will assist in guiding the needle to the proper depth, and will be felt under the



rectal wall. A 10-centimeter needle, long enough to easily reach all of the deep layers of the sphincter muscle, is required, as otherwise dilatation of those fibers will be painful and incomplete. As the needle is being carried down to the sphincter, the anesthetic solution should be slowly infiltrated, so that some distention of the tissues will precede the needle point and avoid pain.

A syringeful of anesthetic fluid is now deposited immediately in front of the tip of the coccyx to block the coccygeal nerves and thus further facilitate dilatation. This infiltration procedure consumes 15 to 20 minutes, and must be carried out carefully until anesthesia is complete. Then the finger within the rectum massages the sphincter, and if the muscle has been well injected it will soon relax. If it is not sufficiently anesthetized it will contract upon and "bite" the finger, and we must wait longer. Never begin manipulating, pinching or operating until anesthesia is complete. This applies with equal force to local and general anesthesia. As the sphincter relaxes under the massage, a second finger of the same hand is introduced and if needed a finger of the other hand and the massaging and stretching are continued until the capacity of the sphincter is reached. This maneuver must be carefully performed so that the mucous membrane is not torn or the anal margin otherwise damaged. Just what is the full limit of the sphincter varies with individuals, and the operator's experience is the criterion in each case. By this method there is never any danger of rupturing the muscle, as may occur under divulsion with the speculum. This slow but thorough dilatation of the sphincter is an essential factor in lessening the post-operative pain by avoiding sphincteric spasm. If the hemorrhoids have been habitually prolapsing, the sphincters will be found relaxed, and will not need much dilating. Abscess following a hemorrhoid operation usually results from trauma during the dilatation of the sphincter (most likely to occur if the stretching is hurriedly performed), a perirectal bloodvessel being ruptured, and this resulting in a hematoma, which later becomes infected and thus causes a perirectal abscess.

When the muscle has been thoroughly relaxed it will so remain while we are operating. The hemorrhoids and the anal mucous membrane prolapse well into view under this treatment, and the whole pile can be seen and reached. Although prolapsed internal hemorrhoids may be operated upon without dilatation of the sphincter, I always make this procedure part of my technic, because without it some

part of the pile is apt to remain internal to the sphincter and cause a recurrence at a future time. Therefore, even if the hemorrhoid is within reach without dilatation, the sphincter should be stretched that all hidden nodules may be found. Also if the stump retracts above a tight sphincter, a subsequent hemorrhage might not be detected for some time. Take plenty of time in making the dilatation, because prolonged relaxation cannot be obtained if the stretching is roughly or hurriedly performed.

Having opened the anus and brought the hemorrhoid well outside, it is now infiltrated with a solution of one-half of one per cent. of quinine and urea hydrochloride, using enough solution to distend the tumor thoroughly. The pedicle of the tumor should be injected and also the normal mucous membrane for one-half inch above the pile, as otherwise traction on the pile in handling will cause pain by stretching the sympathetic nerves which come down the rectum from above. By waiting five to ten minutes now before operating, the best effect of the quinine is obtained and post-operative anesthesia is much more satisfactory. The anesthetizing solution should be slowly forced into the pile so as to avoid a sudden painful distension of the tissues. After the needle has been inserted, it may be turned in different directions and the tumor well infiltrated. If more than one puncture is made into the hemorrhoid, the solution runs out as rapidly as it is injected. Sufficient fluid should be injected to blanch a part of the hemorrhoid. If several hemorrhoids are to be removed, they are all injected at this time before the removal of any is begun. Quinine solution is used for this part of the infiltration, because it produces anesthesia that lasts several days, during which time healing is well established. The anesthetizing solution should be used in as limited amounts as will obtain the necessary results, because excessive quantities produce a large exudate, which causes a sense of fullness in the rectum for several days.

The hemorrhoid having been brought well into view, it is picked up at its upper limit with a hemorrhoidal forceps and an incision, beginning in the normal mucous membrane, one-fourth of an inch above the tumor, is carried down on the left side of the pile, then, beginning again at this upper point, a similar incision is carried down on the right side of the tumor. The upper pole of the tumor is now lifted out of its base, thus exposing the vessels as they enter the tumor from above.

The vessels are then grasped with a thin artery forceps and the tumor is cut free. The lateral inci-



sions are carried down to and around the lower border of the hemorrhoid. These lateral incisions are to be kept close to the hemorrhoid, or, preferably, in that part of the mucosa covering the side walls of the pile. The dissection is carried down around and beneath the hemorrhoids to the solid connective tissue or fascia about the muscle coat of the gut, and the pile is shelled out by blunt dissection (figure 1). This enucleation of the tumor is almost a bloodless operation.

The pedicle in the grasp of the forceps at the upper end of the wound next receives our attention. The size of this pedicle varies with the size of the hemorrhoid; still even when the tumor is large and fleshy, the pedicle is slender, because it consists only of bloodvessels and connective tissue supporting structures between them. The pedicle is lifted well up

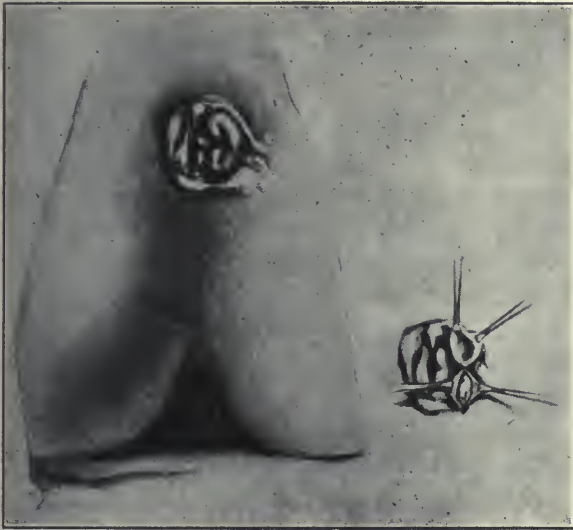


Fig. 1. Enucleating the hemorrhoid.

and examined, in order to make sure that it is thoroughly freed from the mucous membrane, then a No. 1 catgut ligature is slowly and firmly tied close down at the base. One end of the ligature threaded upon a curved non-cutting needle now is passed through the base of the stump beneath the ligature. The forceps and upper part of the stump are now cut free about one-eighth of an inch from the ligature, and the thread that transfixes the stump is tied over the stump and across the encircling ligature, thus preventing it from slipping.

As the stump is released, it retracts well into the bottom of the wound, and the mucous membrane edges fall together over it. It is important to tie the stump carefully, as it is small and, if not properly secured, secondary hemorrhage may result. The wound edges fall together in good apposition, still,

they should be secured by two small interrupted sutures.

If the tumor is in the anal canal, its lower edge may rest at the white line where the skin and mucous membrane meet. If the tumor is of the interno-external variety, it is to be removed completely, by continuing the dissection over the white line and onto the skin, taking out a "V" shaped piece of skin and inflammatory tissue sufficient to restore the anus to a normal appearance (figure 2). Lastly, the wound is closed with two interrupted catgut sutures. When dissecting out the hemorrhoid, be sure to leave a clean-cut, smooth-surfaced wound, as a ragged wound is more liable to bleed.

The lateral incisions are to be kept close to or better upon the edges of the pile to conserve the mu-

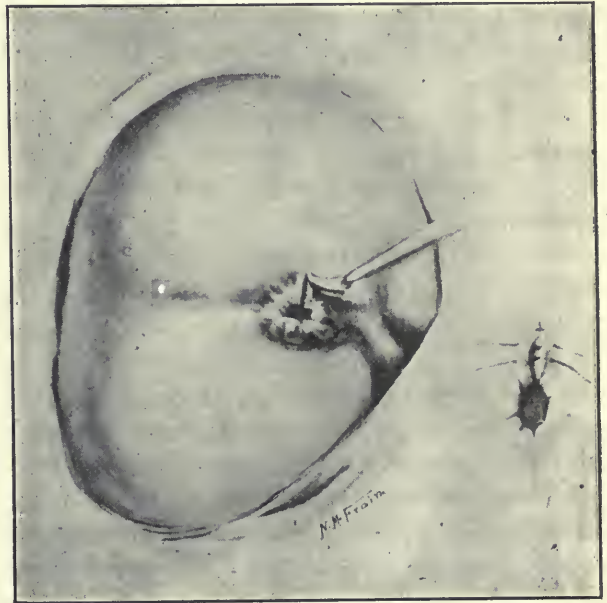


Fig. 2. Carrying the excision out on the skin to remove an interno-external hemorrhoid.

Insert shows sutures placed to close the skin wound.

cous membrane between the several tumors and not endanger the caliber of the rectum or the anal canal by possible subsequent contraction. Those strips of attached mucous membrane left between each two operative wounds will also assist in rapid and satisfactory healing. If this work is poorly performed, stricture of the anus may result. Care must be exercised that none of the incisions extend beyond the anesthetized area.

The hemorrhage during the operation is slight. The large vessels are not injured because they enter the hemorrhoid at its upper part and run parallel with the length of the bowel just under the mucous membrane. If a vessel is accidentally severed, it is an inferior hemorrhoidal vessel at the lower border and



may be picked up and ligated separately or included later in the sutures approximating the wound edges. The operation need not be hurried, as the anesthesia will last upwards of an hour, and the utmost care and gentleness should be exercised in the use of tissue forceps, retractors and sponging. It is important that skin tabs be removed at the time of the operation. Otherwise they become engorged, inflamed, and most painful.

Whether the operation is performed under local anesthesia or general anesthesia, be careful to handle the parts gently, for unnecessary dilatation of the sphincters, rapid or rough manipulations and catching with snap forceps the tissues that are not to be removed, will cause more pain and increased danger of infection.

The operation completed and the field cleansed, the rectum and anus are well covered with sterile petrolatum, carefully and freely covering each and every wound. A light gauze dressing is then applied and held in place with adhesive straps. I do not place a tube within the rectum, because I am convinced that it does not serve any good purpose, while it certainly causes the patient intense pain and is one of the active factors giving rise to retention of urine.

When the patient is put to bed, keep him in the Sim's position, or else on his face. Do not allow him to lie on his back, because, in this position, the middle and superior hemorrhoidal vessels in their upper portion are in a vertical position; at the pelvic brim, they bend at a sharp angle, so that the abdominal contents are superimposed. All of these positions cause obstruction, and as the hemorrhoidal vessels have no valves, there is a back pressure and a tendency to swelling, a giving away of the stitches and more pain, as well as delay in the process of repair. After the first day in bed our patient may turn about and assume a comfortable position.

*After-Treatment*—The after-treatment of hemorrhoid patients is a very exact one, but unfortunately, often is neglected, with the result that complications frequently occur. Although general standard rules for the post-operative care can be set down, there is much to be individualized in each case. In fact, it is most important that the operator himself look after his patients, so far as this is possible; for, just a little slip in the after-treatment may spoil the effect of an otherwise excellent operation.

The post-operative diet for the first day consists of liquids given every two hours; soup, broth, egg albumen, buttermilk and cream, four ounces of either, with two ounces of water. No milk is allowed. On

the second day, order semi-solids: poached egg, toast, custard, rice, sago, absorbable vegetables, also cooked apple, prunes or other fruit, and for beverage, tea, coffee, grape-juice, lemonade and orangeade. After this a regulated general diet is allowed.

These patients expect defecation to cause terrible pain, and I presume that their fear acts as an inhibition to evacuation. So at the end of the second day, I give an injection of six ounces of liquid paraffin, using a soft catheter, letting the patient use a commode, instead of the bedpan. Each day thereafter he is given an enema of eight ounces of physiologic salt solution or of glycerin, two ounces, and water six ounces. Wet absorbent cotton is employed as a detergent after each evacuation.

When the patient leaves the hospital, his hemorrhoids are cured; however, in many cases there still remains the effect of long-continued disturbed digestion. Therefore, the patient should be impressed with the importance of the after-treatment, and should receive either direct or at the hands of his home physician whatever directions regarding his diet and medication may be necessary.

I never use bichloride of mercury during the operation, nor in any of the after-dressings, because this irritant sets up a lasting tenesmus as soon as the sensory nerves recover.

#### *The Advantages of This Technic—*

1. The operation is thorough and may be satisfactorily performed under local or general anesthesia. The incised wounds, if carefully coapted, heal more readily than will crushed or cauterized surfaces.
2. The sphincter muscles are not disturbed or injured by forcible dilatation, since a speculum is not employed.
3. The ligature is so applied as to hold the vessels securely, so that secondary hemorrhage cannot occur, neither is there any sloughing tissue to separate several days later.
4. The stump is small and buried, and the wound edges are closely approximated, so that the resulting scar is smooth and level with the surrounding mucosa, instead of being raised; consequently it does not obstruct the passage of the feces. It is this raised hard scar left after operation for the removal of hemorrhoids that more than any other factor tends to induce a recurrence of the trouble.
5. All of the diseased tissue is removed, therefore recurrence is impossible; yet enough of the mucosa is left to maintain in good order the tactile sensibility of the anus. This is one of the points of superiority over a clamp and cautery method of operation, which



necessarily must grasp much tissue outside of the hemorrhoid or else leave part of the varix behind. If a portion of the varicose vein remains, infection and abscess are prone to occur.

30 NORTH MICHIGAN AVE.

# PYELOGRAPHY AND URETEROGRAPHY IN DIFFERENTIAL DIAGNOSIS OF SURGICAL CONDITIONS.\*

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Following the widespread use of the cystoscope by competent urologists, many absolute diagnoses of urological conditions were made possible. This, together with the constantly improved technique in radiography, especially of the bladder, ureter, and kidney made it furthermore possible to diagnose various obscure cases of the urinary tract that otherwise went undiagnosed. The interpretation of suspicious shadows that may be phleboliths, calcified lymph glands or gall-bladder calculi in many instances cannot be depended upon; likewise, it is a recognized fact that all calculi in the urinary tract do not cast a shadow on the  $x$ -ray plate.

Recognizing these defects, investigators set out upon developing possible methods of outlining the course of the ureter and kidney, and in this country credit is given to Schmidt and Kollischer<sup>1</sup> in 1901 for being the first to employ ureterography, i. e., outlining the course of the ureter, although Braasch<sup>2</sup> in his book on pyelography mentions Tuffier as being the first, his work being done four years previous to that of Schmidt and Kollischer. Schmidt and Kollischer employed the use of fused wire inserted into the ureter for radiography. This at the time enabled one to exclude many shadows that otherwise would be considered probable calculi. Inasmuch as a pyelogram could not be obtained by this method, it remained for Volker and Von Lichtenberg<sup>3</sup> in 1906 to introduce pyelography, i. e., the outlining of the pelvis of the kidney, by the employment of the injection of a shadow-casting substance, namely, collargol.

Pyelography passed through a stage of only partial success at first, but in the past seven or eight years, it has been employed extensively. During these years various silver salts were used, among them being collargol, silver iodide, argyrol, electrogol, gas and oxygen, then to be followed by thorium nitrate,

which was first used by Burns.<sup>4</sup> Recently the iodides have been used by Cameron<sup>5</sup> with apparently good results.

All the drugs used passed through their stage of criticism on account of their irritating effects principally. Some caused destruction, and therefore their use became obsolete. Others caused violent reactions, and likewise fell into the same class. Personally, of all the solutions used, I receive best results with thorium nitrate in 15% solutions, and sodium iodide in 13.5% solutions. Under ordinary circumstances this casts the best shadow, and is the least irritating of all the solutions.

In the early days of pyelography, the solution was injected into the kidney pelvis with a hand syringe, but owing to the reaction and the disastrous results that followed, this method gave way to the gravity method, which was first suggested by Baker<sup>6</sup> in 1910, but first applied to pyelography by Uhle<sup>7</sup> several years later.

In my own work, both the gravity and syringe methods have been employed, but at present the syringe method entirely, using a special technique.

## TECHNIQUE.

The procedure has been as follows:

No purgative should be given twenty-four hours previous to the radiographic examination, so that when a plain radiograph is made, the distribution of gas in the bowel will not be disturbed, as this frequently makes some difficulty in interpreting suspicious shadows. Plain radiograms are always made first, and suspicious shadows are noted and used for comparison when the ureterogram or pyelogram is made, often giving one a probable clue. On the following day, as a rule, cystoscopy and pyelography or ureterography are performed, using a radiographic catheter. If leakage is present a Garceau catheter should be resorted to. The catheter is inserted slowly into the ureter on the suspected side for about eight to ten inches, if no obstruction is encountered. The required distance is measured approximately on the catheter before the insertion. The purpose in making these measurements is, if possible, to allow just the tip of the catheter into the pelvis of the kidney, but not to lodge it against any kidney tissue, this being one of the causes for the intense pain following some pyelographies. So, if in doubt about the measurements, insertion is made until the natural obstruction is encountered, and then withdrawal about one to one and one-half inches. By inserting a catheter into the pelvis of the kidney, there are two possibilities: one, that the tip of the catheter be-

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comes lodged or scrapes against some kidney tissue and produces some trauma; and, two, that the catheter becomes obstructed, due to some ureteral epithelium getting into the eyes of the catheter, blocking the outflow of urine. Many times we call it reflex inhibition, which returns to normal as soon as we wash out the catheter. The Garceau catheter was employed in all cases where leakage was present.

The capacity of the kidney is always determined by injecting, very slowly, sterile water through a ureteral catheter into the kidney with a graduated syringe. When the patient complains of a fullness or beginning pain in the renal region, this is considered the capacity. (Goldstein<sup>8</sup>). The injection of the opaque solution is next carried out, always injecting 1 to 2 cc. less than the total amount of water injected, thereby never causing any distention, which is another cause of pain in pyelography. The injecting substance is always drained before the catheter is removed, and then washed out with water. Both kidneys are never injected at one sitting.

The following are conditions in which, with the employment of ureterography and pyelography, a more absolute diagnosis or a more absolute elimination can be determined:

1. Suspicious ureteral *x*-ray shadows.
2. Suspicious renal *x*-ray shadows.
3. Suspicious gall-bladder shadows.
4. Hydroureter.
5. Hydronephrosis.
6. Pyonephrosis.
7. Ureteral angulations (kinks).
8. Suspicious masses.
  - (a) in the renal regions.
  - (b) in the upper right or left abdominal quadrant.
  - (c) in any part of the abdomen.
9. Appendicitis.
10. Ureteral stricture.
11. Nephroptosis.
12. Anomalies of the kidney and ureter.
13. Neoplasms of the kidney.
14. "Essential" hematurias.

How often is the physician or surgeon confronted with a patient having a mass in the abdomen or in the renal region, or a complaining of pain in the renal region, the abdominal or iliac regions? This, in my experience, occurs very frequently, and I am certain it occurs frequently in the practice of other physicians and surgeons. And how frequently is the condition left undiagnosed, or the patient undergoes operation, and many times no pathological

lesion is found, or there is a recurrence of symptoms in spite of an operation? This likewise has frequently occurred to many physicians in former years, but the advances in surgery today have reduced this number considerably. In spite of the fact that we have at our command newer and more accurate methods, there are many who still disregard the application of these methods. Certainly, should a patient present himself for examination with all the classical signs and symptoms of a certain disease, the average physician diagnoses the case. But it is a fact that in a large percentage of cases the symptoms and signs are not classical. Furthermore, are we not finding today that the classical signs and symptoms of a given disease are also applicable for other diseases?

With the application of ureterography and pyelography in differential diagnosis certain conditions can be excluded that otherwise could not.

A. *The differential diagnosis of ureteral calculi, ureteral kinks or angulations, ureteral strictures, appendicitis, "essential" hematurias, calcified lymph glands, phleboliths and hydroureters.*

The above conditions can all be considered in one group, and can be differentiated by the use of the ureterogram. In considering ureteral calculi, certain classical signs and symptoms flash through our minds, principally:

1. History of ureteral colic, requiring morphia injections.
2. The presence of red blood cells in the urine.
3. A shadow on the *x*-ray plate.

Patients have been seen that had any one, combination of two, or all three of the above signs and symptoms, and still had no ureteral calculus. Frequently the various combinations occurred, and while in many cases the diagnosis was correct, there were many cases where, unless the ureterogram was employed, the diagnosis was incorrect. This is perfectly simple to explain in that we are aware of the fact that invariably, ureteral kinks and ureteral strictures (Hunner<sup>9</sup>, Goldstein<sup>10</sup>) will cause a slight hemorrhage, which will enable us to find red blood cells in the urine, and the patient will suffer with a ureteral colic. Some nephritic cases will show red blood cells in the urine, but will not, as a rule, have ureteral colicky pain unless another condition is associated directly with it.

It is conceded that pain in the right iliac fossa is produced in a large percentage of cases by a diseased appendix, but it is also true that appendices have been removed and the pain still persisted, and on a more



careful examination some urological condition was discovered.

None of the aforementioned conditions will cast a shadow on an *x*-ray plate, but a phlebolith, a calcified lymph gland and a large percentage of ureteral calculi will; therefore, there must be some means of differentiating the last-mentioned conditions that will not show on an *x*-ray plate. For this work we employ the ureterogram, and by a comparison of the plain plate with the ureterographic plate we are able to be more absolute in our diagnosis of these various conditions in the following manner:

1. *Ureteral Calculus*: The following observation will be made,—A shadow on the plain radiographic plate in a large percentage of cases; a scratch on the wax-tipped radiographic bougie; the shadow will be in the same line with the radiographic catheter or should it be a large shadow it will be located at the end of the catheter if it could not pass; if an opaque solution is used for the ureterogram it will show in many cases a narrowing just below the shadow and a dilatation above the shadow, with an intensification of the shadow.

2. *Stricture of the Ureter* will show, after the opaque solution has been injected, a narrowing at some point in the ureter, and a dilatation above it.

3. *Ureteral Angulation* will show definitely after the ureter has been injected with an opaque solution and a simultaneous radiogram made (a condition that could otherwise not be diagnosed).

4. *Appendicitis and Uncomplicated Nephritis*: The ureterogram will be normal.

5. *Calcified Lymph Gland and Phlebolith*: The shadow will be seen to the inside or outside of the ureter after a radiographic catheter has been passed.

6. "*Essential*" *Hematuria*: The ureterogram will be negative unless there is an associated stricture.

7. *Hydroureter* can be diagnosed only by the ureterogram after an opaque solution has been injected. This condition is usually associated with a stricture somewhere below, and usually accompanies a hydronephrosis.

B. *The differential diagnosis of renal calculi, gall-bladder calculi, appendicitis and calcified lymph glands.*

It is unnecessary to discuss the classical signs and symptoms of the above conditions. Two of these conditions can be present at the same time. Frequently both are present and the diagnosis of one is overlooked. Frequently the patient is operated upon for one condition, and the findings are negative, due to the fact that some other condition is present. Hav-

ing taken a plain radiograph for comparative purposes and noting the shadows, the opaque solution is injected for a pyelogram and the differential diagnosis made as follows:

1. *Gall-bladder calculi*: The shadow will be extra-renal, and a normal pelvis will be observed with normal calyces.

2. *Calcified lymph glands*: If the shadows are of calcified lymph glands in the region of the kidney, they likewise will be outside the outline of a normal pelvis and calyces.

3. *Appendicitis*: A normal kidney pelvis and calyces will be demonstrated.

4. *Renal Calculus*: Here the information obtained is very valuable. The shadow or shadows are intensified by the opaque solution, making the diagnosis definite. The location of the shadows will be noted, which is important at the time of operation, and the presence or absence of a small or large, or a diseased or normal kidney will be noted.

C. *Hydronephrosis, Pyonephrosis, Nephroptosis, Floating Kidney, Renal Neoplasms and Suspicious Masses of the Abdomen.*

In the pyelographic differential diagnosis of the above group of cases there are many points to be emphasized. A plain radiographic plate in this group of cases many times gives the surgeon a clue, especially if any special symptoms and signs are present.

1. *Hydronephrosis and Pyonephrosis*: Here, the pyelogram informs you of the approximate size of the kidney, also of its condition. Where there is destruction, the outline is not clear and the diagnosis can readily be made. Unless the organ is very large or has caused some severe symptoms, the condition usually goes on for quite a period of time before it is noticed. Both of these conditions are usually associated with some other lesion in the urinary tract and pyonephrosis follows hydronephrosis. A tentative diagnosis is usually made before pyelography is resorted to, which assists greatly in deciding the diagnosis in most cases.

2. *Nephroptosis and Floating Kidney*: This can most of the time be diagnosed without pyelography, but the application of the pyelogram here differentiates it from other masses that may be in this location. One might be under the impression that he is palpating a misplaced kidney, which in reality is some other organ, but with the pyelogram this is absolutely determined, as the outline of the kidney and its position are seen. Another important point in connection with this is that should the diagnosis of a floating or misplaced kidney be established, operation cer-



tainly should not be attempted without a pyelogram to determine the following important points:

1. Is the kidney congenitally misplaced, having a normal but short ureter?
2. Is a kink present that will allow for a shortening?
3. Is a stricture present?

At best, in these cases operative procedure is not very satisfactory, so that one must travel very carefully, and certainly should never undertake an operation for this condition without a pyelogram having been made.

3. *Suspicious Abdominal Masses and Renal Neoplasms*: If one is not certain of the nature of the mass, a pyelogram should always be resorted to. I have observed cases that were diagnosed as gastric, splenic, and pancreatic tumors, etc, in which pyelograms revealed a large kidney. Renal neoplasms, fortunately, are not very common compared with those of other parts of the body. The most common kidney tumor is hypernephroma.

Papillomata of the pelvis occur at times (one in my experience) and, like hypernephromata, they are supposed to present, as the principal symptom, profuse and painless renal hematuria. But since hemorrhage is a classical sign of other renal diseases, it would be difficult to make a diagnosis from the hemorrhage alone in an early case of hypernephroma. The pyelograms in the cases of renal neoplasms are usually characteristic in that the outline of the pelvis and calyces is irregular. In most instances the picture shows elongated and narrow calyces, and a deformed pelvis. To differentiate the condition from "essential" hematuria by the pyelogram is simple, for the pyelogram in cases of "essential" hematuria is normal in contour.

D. *Anomalies of the Kidneys*: Without an injection of a shadow-casting substance it would be impossible to diagnose certain anomalies, such as incomplete bifurcation of the kidney pelvis, complete reduplication of the pelvis with one ureter, the presence of one pelvis for two ureters, the presence of a horse-shoe kidney that cannot be palpated.

#### CONCLUSIONS.

1. Ureterography and pyelography is a harmless procedure, if the technique is carried out properly.
2. It is not contraindicated in any abdominal case where there is a suspicion of a urinary tract lesion.
3. It is absolutely essential for diagnosis in many urological conditions.
4. For differential diagnosis it is a great aid to the surgeon.

330 N. CHARLES ST.

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#### VESICAL PAPILLOMA.

The type of the papilloma is extremely important in determining the treatment, as it is generally conceded that very satisfactory results can be obtained in being papillomas by fulguration, and in malignant papillomas that it is best to excise the tumor. If there is some uncertainty with regard to malignancy, and the tumor is small and such as ordinarily would respond to fulguration, it is best to try this treatment at least as long as it is evidently accomplishing something. Often fulguration may be a good test of the nature of papillomas as malignant papillomas, instead of being reduced by it, seem to be stimulated in their growth. If there is any uncertainty as to the pathology of a papilloma of the bladder, the growth should be observed most carefully during the fulguration, and the treatment discontinued if there is no response within a reasonable time. This, of course, must be determined by the physician giving the treatment; but the point should be emphasized that a number of patients have been observed in whom fulgurations have been continued for a year or more while seemingly the growth had been progressing. Such patients have little chance from operation. The results of any form of treatment for malignant tumors of the bladder are not entirely satisfactory, but the late stage of the disease at which operation is performed in many cases is apparently responsible for some very unsatisfactory results. Fulguration gives very gratifying results when it is used in the proper cases.—E. S. JUDD and W. E. SISTRUNK in *The Journal A. M. A.*



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### DEVELOPMENTS IN INTRATHORACIC SURGERY

It is very interesting, to say the least, to note the advances, diagnostic and therapeutic, in the surgery of the intrathoracic organs. Here, far more than in any other part of the body, methods and technic—surgical strategy and tactics—are still undeveloped. True, several years ago Trendelburg removed an embolus from a pulmonary artery and Torek successfully resected the esophagus intrathoracically for a carcinoma. But these are isolated instances and, in the latter case especially, they by no means represent a standardized procedure. In fact, the elective, major surgery of the chest organs has not developed to the stage where it has become the possession of the many; it is still an experimental field for the pioneers.

Several factors, however, have served to advance this experimental work. Notable among these was the differential pressure cabinets of Sauerbruch, soon superseded by the more convenient intratracheal anesthesia method of Meltzer, and this by the still simpler intrapharyngeal narcosis. The war gave a great impetus to intrathoracic surgery, not only in the treatment itself of gunshot wounds of the lungs and of empyema, but also through the study of the mechanics and physiology of the lungs and the mediastinum, upon which such treatment is be-

ing more and more solidly established. Certainly we know far more than before the war concerning pneumothorax—beneficent and otherwise—hemothorax, pyothorax, "sucking wounds", "pleural eclampsia", penetrating wounds of the lung and the pericardium; and, what is equally important, a larger number of competent surgeons is today familiar with the physiology and pathologic responses of the chest organs and the surgical problems that these involve.

Bronchoscopy has developed as a surgical art, not merely in the removal of foreign bodies and specimens, and in diagnosis by direct inspection, but also in local treatment; Yankauer has cured some cases, and controlled others, of lung suppuration by irrigations through the bronchoscope. Lilienthal recently demonstrated before the New York Surgical Society a case of carcinoma of the lower esophagus successfully resected through a posterior, extrapleural approach; he has extirpated a dermoid cyst from the mediastinum; and he and others have cured abscess of the lung by removing the diseased lobe—a procedure that, though it may be further developed in technic, may be said to have advanced beyond the experimental stage. Tuffier has evolved a method, or methods, of compressing the affected lobe in cases of pulmonary suppuration unfit for the graver operation of lobectomy. Operations upon the heart have been, with few exceptions, for the suture of stab- and bullet-wounds and for the removal of missiles, but the correction of a valvular stenosis or the removal of obstructing vegetations is quite possibly within the sphere of future developments.

The intensive study of thoracic roentgenograms and of fluoroscopic appearances has been an important feature in the differential diagnosis of lesions at various stages before and after operation. The war has also stimulated this work and increased both the number and the proficiency of those interested in it. It is in this diagnostic side of surgical lung affections that another and important aid has come to us, viz., the outlining of the bronchial tree and of communicating cavities by bismuth injections through the bronchoscope. In cases of tracheo-esophageal fistulae it has been noted that the bronchial tree has been outlined by bismuth swallowed to demonstrate, roentgenographically, the lesion in the gullet, and that the accidental entrance of the bismuth mixture into the lungs, wherefrom it was soon expelled by coughing, did no harm. Three years ago Chevalier Jackson reported a case in which he had demonstrated the main bronchi roentgenographically after insufflating powdered bismuth through the bronchoscope. Two years ago Bullowa and Gottlieb injected the bronchi of living animals



with bismuth and barium mixtures and studied roentgenographically the movements of the smaller branches in respiration and in coughing. In *Annals of Surgery*, March, 1921, Lynah, bronchoscopist, and Stewart, roentgenologist, state that bismuth emulsion, injected through the bronchoscope, slowly and in moderate amount, is safely borne by the human subject, and they report five cases of lung abscess in which roentgen examination immediately after the injection gave much information. The bronchoscope cannot penetrate into the smaller ramifications of the bronchi, nor through it can one "see around all the corners". It does not fully discover the extent of the disease in the lung tissue; nor, for obvious reasons, will simple roentgenography always reveal the extent and character of lung cavitation. The injection of an opaque substance like bismuth bids fair to supplement bronchoscopic inspection and simple roentgenography, and to supply the more detailed picture that will demonstrate the lesion more exactly and determine, for example, a choice of proceeding between intrabronchial treatment and operative attack. It seems to us a noteworthy step forward in pulmonary diagnostics, in the development of intrathoracic surgery.

#### THE CURABILITY OF BONE SARCOMAS.

The giant-cell bone tumor is a relatively benign growth, often completely cured by removal, or by destruction in situ. Round- and spindle-cell bone sarcomata, however, whether central or periosteal growths, are at the opposite end of the scale of malignancy; and early metastasis (usually in the lungs) is the common experience even after the most radical operation—amputation.

How often does surgical treatment, by resection, by amputation, effect a cure in cases of round- and spindle-cell sarcoma? When it does not prevent, how often, if at all, does it delay metastasis? What has been accomplished by radium, by x-rays, by other forms of treatment, in saving or in prolonging life in these cases? It must be admitted that we have no statistics that furnish an answer to these questions. Two surgeons, Drs. Joseph Bloodgood and Ernest Codman, and a pathologist, Dr. James Ewing, have formed a committee to acquire such statistics, whereby to determine the relative malignancy of various types of bone sarcoma, in various regions of the body, and to establish what method, or combination of methods of treatment, affords the greatest prospect of cure. This study will be based upon the data of cases that are or were alive after January 1, 1920; and the committee requests all hospitals and individual physicians to send to Dr. Codman (227 Beacon

Street, Boston) full details of every case after that date, whether now dead, apparently "cured, still under treatment or even if moribund." The registration will be continued for several years and will no doubt furnish a much-needed information. It deserves the cooperation of the profession. Upon request Dr. Codman will furnish the form for supplying the details desired.

#### FRACTURE NUMBER

The next number of the JOURNAL will be a special issue devoted to Fractures. It will contain the following contributed articles:

Treatment of Fractures of the Humerus, by Joseph A. Blake, New York.

The Development and Application of Traction-Suspension Apparatus, by Harry H. M. Lyle, New York.

Early and Complete Immobilization as a Factor in the Preservation of Joint Function in the Treatment of Fractures, by H. Winnett Orr, Lincoln, Nebr.

Pott's Fracture, by W. L. Estes, South Bethlehem, Pa.

Treatment of Fractures about the Ankle, by Frederic J. Cotton, Boston.

Intertrochanteric Fractures of the Femur, by Kellogg Speed, Chicago.

Fractures of the Tibia, by John J. Moorhead, New York.

Fractures of the Fingers and Toes from Industrial Accidents, by Harry E. Mock, Chicago.

Fractures of the Head and the Neck of the Radius, by James Morley Hitzrot, New York.

Cerebral Symptoms and Operative Indications in Skull Fractures, by William Sharpe, New York.

Latent Symptoms from Unrecognized Fractures of the Vertebrae, by Norman Sharpe, New York.

Bedside Roentgenography, by I. Seth Hirsch, New York.

These articles have been prepared in response to requests made to the individual surgeons for contributions upon the respective assigned topics. They cover a considerable range of important fracture-groups; and their discussion, from the standpoint of modern methods of treatment, by distinguished surgeons especially familiar with their subjects, will make the May issue of the JOURNAL a particularly valuable one.

In operations upon the orbit, the frontal sinus, etc., an incision in the line of the eyebrow is not to be recommended cosmetically. The resulting scar is apt to be much more disfiguring than one just below the eyebrow.



## Book Reviews

**Diagnosis and Treatment of Brain Injuries**, with and without a Fracture of the Skull. By WILLIAM SHARPE, M.D., Professor of Neurologic Surgery, New York Polyclinic Medical School and Hospital, Consulting Neurologic Surgeon, Manhattan Eye and Ear Hospital, Hospital for Ruptured and Crippled, Beth Israel Hospital, New York City, and Nassau Hospital, Mineola, Long Island, etc., etc. Octavo; 736 pages; 232 illustrations. Philadelphia and London: J. B. LIPPINCOTT COMPANY, 1920.

This is a critical and very useful treatise on that phase of neuro-surgery that most interests the general surgeon, since it is concerned with those emergency conditions—cranial injuries—that usually come under his care. Sharpe is especially competent to write on this subject, for he has had an unusually rich experience in this aspect of brain surgery. From 1913 to 1918 he treated 487 adults having acute brain injuries, with and without fracture, 155 of whom he operated upon to relieve increased intracranial pressure. Of these, 68 had fractures of the base of the skull. He has seen many hundreds of cases of cerebral injury from birth hemorrhage, and operated for increased pressure upon 364 of these (in only 25 of which was primary destruction of brain tissue found at operation or autopsy).

The book is divided into three parts. Part I deals with Diagnosis and Treatment of Brain Injuries, and includes a clear presentation of the indications for, and contraindications to, operation in cranial traumata, and a very complete description of the operation of subtemporal decompression. The latter is well illustrated, although the several pages of small "moving pictures" of the operation show little more than a couple of dozen artery forceps festooned about a dark hole in the towels. Sharpe emphasizes that in cranial injuries the most important question is not *is there a fracture of the skull?*, but *are there signs of a threatening increase of intracranial pressure?* An extensive fracture may be uncomplicated by any symptoms requiring surgical intervention, and a threatening intracranial hemorrhage requiring prompt operation, may follow an injury to the skull without any fracture. A depressed fracture should be raised, or the fragments removed, whether or not there are symptoms of increasing pressure, but in any case where these exist it is wholly wrong to delay operation several hours in order to secure a roentgenogram. Sharpe describes the signs and symptoms of increased pressure and makes it clear that the most important diagnostic instruments are the ophthalmoscope and the spinal fluid manometer. He emphasizes the danger—and the futility—of operating in the stage of shock (the symptoms of which are set forth), and the danger also, after this has passed, of delaying operation until increasing pressure approaches medullary compression. One should not wait for "choked disk" as the ophthalmoscopic sign of increased intracranial pressure; the earlier, milder retinal signs—dilatation of the veins, blurring of the disk margins—are sufficient evidence of dangerous pressure, in conjunction with manometric determination of the spinal fluid. The pupillary signs are analyzed, and their significance balanced with the other signs and symptoms. Other neurological and general signs and symptoms are discussed seriatim, and their value set forth in determining the presence of an intracranial lesion, and in its localization.

In the treatment of penetrating gunshot wounds of the brain Sharpe appears to be out of accord with the teachings of the war. While he admits that "the greater danger of infection of war wounds of the brain make [*sic*] these cases very serious ones indeed", he says "By no means should the brain be probed or explored for bone and bullet fragments. . . . There is little danger from subcortical foreign bodies other than that of infection and the mere removal of the foreign body does not lessen that danger, as it would have occurred at the time of the injury." [*Italics ours*] The war taught us that contamination, but not infection takes place "at the time of the injury", and that the prompt removal of foreign bodies and the thorough me-

chanical cleansing of the wound, whether of the brain or elsewhere, very often *does* prevent infection! We are quite sure that those who practiced in the war the developed technics of operation for gunshot wounds of the brain, and those who know how much these procedures reduced the ultimate mortality, will not agree with Sharpe's statement, based on a smaller experience, that: "To excise brain tissues freely, [in Cushing's technic the softened brain tissue was not excised but washed out] as if they were so much muscle or fat, when macerated or apparently infected, [the operation was done before infection took place] is undoubtedly necessary and advisable in selected patients, but to state that cranial injuries in the war service should be treated in this manner, as though it were the usual method of treatment of brain injuries, and that this method should be used in civil life, cannot be condemned too strongly".

Parts II and III deal, casuistically, with Acute and Chronic Brain Injuries in Adults, and in Children and the Newborn, respectively. These many case records and their discussion are interesting reading, and impress the importance of careful observation—often of "watchful waiting"—and of balanced judgment. There is a good chapter on Post-Traumatic Neuroses. Concerning traumatic epilepsy Sharpe says that the elevation of depressed fractures of the vault should be undertaken at the time of the injury, as a preventive; the performance of this operation as a cure of established convulsions is often too late. In his opinion "a cranial operation is only indicated for those patients in whom the mental and emotional deterioration is slight, the epileptiform attacks few and of infrequent number and in whom there is disclosed a marked increase of the intracranial pressure which is not. . . . due to the convulsions themselves". The varieties of intracranial hemorrhage in the newborn are described and illustrated by case reports. Sharpe operates in those cases in which there are signs of increased pressure, and in these he believes that decompression is very important.

It is a great pity that so excellent a book should be marred by the clumsy construction of the text. The long, involved, and often ungrammatical sentences are hard to follow. Many sentences occupy fifteen lines of type! We quote a shorter one to illustrate, and as a suggestion to the author that a second edition will deserve thorough editing: "It is this careful selection of patients, not only in regard to the advisability of an operation or not, and, if indicated, then the type of cranial operation used, but of the greatest importance—the ideal time for performing the operation—these factors have made it possible to lower the mortality of brain injuries from the average of 50 per cent. of most hospitals to 28.4 per cent. at the Polyclinic Hospital, and if we exclude the non-operated moribund patients dying within three hours after admission to the hospital from shock, internal injuries and in many cases the brain injury being but an incident in the patient's general condition, the mortality is lowered to only 17.9 per cent."

We commend this book to the interested surgeon, and we believe that it deserves a place in the staff libraries of general and emergency hospitals.

**The Endocrines.** By SAMUEL WYLLIS BANDLER, M.D., F.A.C.S., Professor of Gynecology in the New York Post-Graduate Medical School and Hospital. Octavo; 486 pages. Philadelphia and London; W. B. SAUNDERS COMPANY, 1920.

While written by a gynecologist, this volume attempts to cover the entire subject of endocrinology. The urge of some unknown endocrine imbalance is patent from cover to cover as it represents an obsessive idea as to the part endocrines play in the somatic, mental, and psychic well-being of all animals, including man.

Every single overpowering idea, hypertrophied through the interaction of conjecture and unsupported theories, is stimulating and interesting, but dangerous for those lacking the power of discrimination and judgment, established upon known facts.

Curiously, Bandler in his preface refers to the "aberrations of the theories of Freud" but fails to recognize the aberrations of his own logic and uncorroborated assumptions.



In the introductory chapter he asserts that the differences between animals of various species and within the same species are due to the ductless glands. They are the responsible factors in racial characteristics and the resemblances in body, mind and psyche. This accepted, it is not strange that in his disquisition on heredity and environment, he should say little concerning either of them, but roam over the field of bringing up the young, touching with assurance subjects that are still open to question to more experienced psychologists and educators.

Psychiatrists and psychologists are not prepared to accept the gynecologist's dictum, though based on Dercum, that dementia precox is inherited, with its dependence upon an instability of internal secretory functions. There is a strange admixture of dogmatic conclusions and dubitable hypotheses and assumptive "ifs" that fail to carry conviction despite their redundant expression.

His theoretical considerations of sterility are suggestive, but by no means informing; nor are there adequate data to validate his belief that the posterior pituitary is the basic cause of uterine fibroids.

Admitting that 90% of his medication consists of endocrine extracts it is not unexpected to have endocrine activity (plus, minus or dys—to use his terms) made the basis of instincts, emotions, resemblances, somatic changes, mental variations and psychic manifestations. It is all too simple and too complex to be true on the basis of supporting evidence. It requires a sublime faith to prophecy (page 312) that there will be a decrease of defectives, feeble-minded, insane, tumors, cancers, diabetes, renal diseases, etc., because "due to endocrine aberration they will be corrected in their earliest stages by endocrines".

Possibly enthusiasts are willing to believe that a pyloric spasm in an infant is related by heredity to the hyperpituitarism of its mother. Surgeons may not be prepared, however, to accept post-pituitary activity as blameable for gall stones, renal calculi, and cervical polyps. That the evidence offered is to be taken with more than a grain of salt is well illustrated from one of the rambling clinic lectures (page 358) in which he states: "Mr. Roosevelt had a wonderful thyroid and adrenals and a very wonderful anterior pituitary. He had the paternal instinct in the maternal way and that shows that he had a good post-pituitary. You can tell that from his letters to his children."

It is needless to expatiate. Bandler has written more at length than with breadth. The practical problem of dosage is inadequately discussed. The chapter devoted to "The History and the Symptoms" is a verbal mixture, lacking clarity, certainty, and logical arrangement. The eighty pages of case reports lack plan and uniformity in nomenclature; many are incomplete, others give inadequate data for judgment, and another group contains such a combination of medication as to make a decision on therapeutic value thoroughly unreliable and unscientific. His interpretations are read into symptoms in a decidedly hazardous manner and his *post hoc* conclusions are in constant evidence.

Admitting that his theories represent an attempt to solve vexing problems and granting that endocrinology promises much for the future, the present volume does not allay skepticism nor adequately differentiate truth from fiction, fact from theory, nor endocrines from any other part of life save bacteria. Man is more than an endocrine system, and it will require more than anterior pituitary and cooperating endocrines to stop war.

**The Oxford Medicine.** By Various Authors. Edited by HENRY A. CHRISTIAN, A.M., M.D., Hersey Professor of the Theory and Practice of Physic, Harvard University; Physician-in-Chief of the Peter Bent Brigham Hospital, Boston, Mass., and SIR JAMES MACKENZIE, M.D., F.R.C.P., L.L.D., F.R.S., Consulting Physician to the London Hospital and Director of the Clinical Institute, St. Andrews, Scotland. In Six Volumes. *Volume II: Diseases of Bronchi, Lungs, Mediastinum, Heart, Arteries and Blood.* Imperial octavo; 817 pages; illustrated. London and New York: OXFORD UNIVERSITY PRESS 1921

The second volume of the "Oxford Medicine" gets down to special topics. The dominant impression afforded in

glancing through the articles in this volume is the didactic manner in which the majority of authors present their topics. This manner is so prevalent as to appear purposeful, and the presumption is that this system was primarily devised to appeal to the general practitioner. The text, with some exceptions, certainly appears elementary and superficial. No one can deny that with this object in mind, the volume carries out its purpose admirably. To the medical scholar, however, who especially desires monographs, in which there is an exposition balance between a critical and comprehensive study of the literature and the personal views of the author, these articles, again with a few exceptions, will hardly prove adequate. It seems to us that an appeal to both kinds of readers could have been attempted without sacrificing the interests of either. In fact, some of the articles prove that such is possible.

This volume reveals some of the defects of "systems" of medicine written by numerous authors. Fortunately, overlapping of the text, while common, is not oppressive. But there is a curious distribution of space afforded to the various writers. Leukemia, a comparatively rare disease, is given 84 pages, while diseases of the arteries, including aneurism of the aorta, occupy only 16 pages. "Respiratory Excursions of the Thorax", an important but by no means a vital topic, is given 20 pages, while "Congenital Malformation of the Heart and Large Vessels" and "Irregular Action of the Heart", subjects of far greater consequence are given only 16 and 24 pages, respectively. Furthermore, we fail to see why such a subject as "massive collapse of the lung" certainly an unusual phenomenon, should be afforded a separate chapter and 12 pages of text, while "abscess and gangrene of the lung" are given a scant 6 pages.

The individual articles vary greatly in merit. "Diseases of the Bronchi", by Hoover, is excellent. His article on "Respiratory Excursion of the Thorax" is a restatement of his familiar views. "Diseases of the Lungs", by Hamman, is probably as well presented as the limitations of space (76 pages) would permit. "Diseases of the Pleura", by Capps, is an able presentation. "Diseases of the Mediastinum", by McLester, is only satisfactory. "Bronchial Asthma" and "Hay Fever", by Walker, are among the best articles in this volume. "Diseases of the Pericardium", by Clifford Allbutt, is a gem. It is scholarly, comprehensive and full of valuable personal observations. His quaint literary style is a relief from the drab matter-of-fact manner of writing of most medical authors. "The Circulation in Infections and Toxic Processes, including Endocarditis", by Ivy Mackenzie, is downright poor. It is verbose, discursive and archaic. The description of subacute bacterial endocarditis, an important disease, shows an entire lack of acquaintance with the most recent studies. "Irregular Action of the Heart", by Thomson, and "Chronic Diseases of the Heart", by Sir James Mackenzie, are excellent. Thomson did as much as was possible within the 16 pages devoted to "Congenital Malformation of the Heart" but the text leaves one with a sense of its woeful inadequacy. The article on "Disease of the Arteries and Aneurysm of the Aorta", by Girdwood and Mackenzie, is poor. Arterial blood pressure, for instance, is dismissed in a page and a half. The text is superficial to a degree. The succeeding chapters on "The Pathological Physiology of Blood-cell Formation and Blood Cell Destruction", by Drinker; "Clinical Discussion of the Anemias" by Minot; "Leukemia", by Ordway and Gorham; "Polycythemia", by Fitz; and "Hemophilia", by MacLean, are without question the most valuable ones in this volume. We suggest that they serve as models for subsequent contributions. "Purpura and Allied Conditions," by Christian, is good but padded.

#### BOOKS RECEIVED.

**Doederlein-Kroenig Operative Gynaekologie.** IV Auflage. Bearbeitet von Dr. med. et Dr. art. obs. h. c. ALBERT DOEDERLEIN, Geheimer Hofrat, O. O. Professor der Geburtshilfe und Gynaekologie; Direktor der Universitäts-Frauenklinik, Muenchen. Imp. Octavo; 1028 seiten; 455 teils farbigen abbildungen und 15 farbigen tafeln. Leipzig: GEORG THIEME, 1921.



# American Journal of Surgery.

## QUARTERLY SUPPLEMENT of ANESTHESIA & ANALGESIA

(American Journal of Anesthesia and Analgesia)

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April

## CONTENTS OF THIS ISSUE

1921

BLOOD PRESSURE GUIDES DURING ANESTHESIA AND OPERATION	A. H. Miller Providence, R. I.	34
A DROP METHOD OF ETHER VAPOR ANESTHESIA AND APPARATUS FOR ITS ADMINISTRATION	S. G. Davis Baltimore, Md.	37
PRIMARY AND SECONDARY NITROUS OXID SATURATION AS A TEST FOR DETERMINING THE CAPACITY OF THE PATIENT FOR OPERATION	E. I. McKesson Toledo, O.	43
STUDIES IN THE EFFECTS OF NITROUS OXID-OXYGEN ANESTHESIA ON ANIMALS INFECTED WITH TUBERCULOSIS THROUGH THE RESPIRATORY TRACT	J. B. Rogers Cincinnati, O.	44
THE PSYCHOLOGY OF MUSIC IN RELATION TO ANESTHESIA	E. L. Gatewood Pittsburgh, Pa.	47
ANESTHESIA IN RELATION TO MEDICAL SCHOOLS AND HOSPITALS	I. C. Herb Chicago, Ills.	50
ON THE RATE OF EVAPORATION OF ETHYL CHLORID FROM OILS	C. Baskerville New York City	52
SYNERGISTIC ANESTHESIA FOR DENTAL SURGERY	M. Ecker New York City	54
STANDARDIZATION OF NITROUS OXID-OXYGEN ANESTHESIA INDUCTION	J. A. Hiedbrink Minneapolis, Minn.	56

### DEPARTMENTS

EDITORIALS	59	SOCIETY PROCEEDINGS	61
BOOK REVIEWS	62	QUARTERLY INDEX	63



## BLOOD PRESSURE GUIDES DURING ANESTHESIA AND OPERATION.\*

ALBERT H. MILLER, M.D.,

PROVIDENCE, R. I.

Shock is defined as an acute prostration of the vital functions. Such a condition resulting from surgical traumatism is designated surgical shock. In view of the confusion attending our ideas of surgical shock, it is well to restrict the use of this term to the limits of the definition, employing other designations for the effects of hemorrhage or of anesthetic drugs.

From a review of the reports of several hospitals, it appears that from 15 to 45 per cent. of the postoperative mortality is ascribed to surgical shock. These fatalities occur not only among the serious cases but following such trivial operations as incision and drainage, minor amputations, the reduction of simple fractures, and uncomplicated appendectomies. We cannot continue to be satisfied with our diagnosis of surgical shock in these cases without a more careful study of the subject than has been made in the past.

## NECESSITY FOR ROUTINE BLOOD PRESSURE EXAMINATION.

Considering the frequency with which the diagnosis of surgical shock appears, in trivial as well as among serious cases, and the value of blood pressure tests in detecting this condition, it seems reasonable to require that routine blood pressure examinations be made in every operative case. The systolic and diastolic pressures, by the auscultatory method, are to be taken and recorded at the preliminary examination, at 5 or 10 minute intervals during each operation, and as frequently following operation as may be indicated by the condition of the patient at the termination of operation. The topics for investigation include the effects of surgical traumatism and of other factors found to modify the blood pressure during operation; such as the temperature of the operating room, the posture of the patient, an obstruction of the airway, the patient's organic defects, the influence of hemorrhage, or the effect of anesthetic drugs.

## EFFECTS OF SURGICAL TRAUMATISM.

Accepting the blood pressure as a reliable index to shock, if the usual conception of surgical shock were correct, we should expect to find a distinct fall in blood pressure attending every severe surgical operation and the effect should be more pronounced

in case the patient had not the protection supposed to be afforded by deep anesthesia. On the contrary, routine blood pressure work shows that if the factors other than surgical traumatism be favorable, the most severe surgical manipulations may regularly be performed without marked change in either the blood pressure or the pulse rate. Given a smooth, light anesthesia, an operating room at a temperature between 70° and 80° Fahrenheit, an organically sound patient, the dorsal position, protection from hemorrhage and from obstruction to the respiration; gastro-enterostomy, intestinal resection, cholecystectomy, complete proctectomy, and major amputations are regularly accompanied by no marked change in the blood pressure. This a statement not of theory but of fact and can be demonstrated from the blood pressure charts of hundreds of operations.

It is not the intention to state that shock cannot be produced by surgical manipulations but that, in the present development of surgical technic, the condition diagnosed as surgical shock usually results not from surgical traumatism but from other factors which if understood might be controlled.

## EFFECT OF HEMORRHAGE.

In the presence of considerable hemorrhage, the blood pressure may fall steadily with a corresponding increase in the pulse rate or both pulse and blood pressure may remain stable for some time and then suddenly give way. In a case of persistent hemorrhage from the hepatic vein, the pulse and blood pressure were unaffected for 30 minutes. During the next 10 minutes, the systolic pressure changed from 150 to 90 mm., the diastolic from 110 to 80 mm., the pulse pressure from 40 to 10 mm., and the pulse rate from 92 to 132. In such a case, a knowledge of the circulatory condition as shown by the blood pressure readings is of inestimable value to the surgeon.

## INFLUENCE OF THE PATIENT'S CONDITION.

While the blood pressure of the vigorous patient's is more stable, in the cases in which resistance is seriously lowered from any cause, a progressive drop in the systolic, diastolic, and pulse pressures results from factors which ordinarily would not affect the blood pressure. The patients suffering from traumatic or surgical shock are especially susceptible to the effect of the anesthetic. These cases may be safely and satisfactorily anesthetized with a very small amount of the anesthetic but under the usual dosage, rapidly develop a dangerous drop in blood pressure. The blood pressure of the stout patients, especially those with damaged hearts, is susceptible to changes in posture and to

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists, in Joint Session with the Medical Society of the State of Pennsylvania and the National Anesthesia Research Society, William Penn Hotel, Pittsburgh, October 5-7, 1920.



protracted abnormal postures. The blood pressure readings are a reliable guide to the limit of safety in such cases.

A number of patients suffering from exophthalmic goiter or from cardiovalvular defects, especially those of the aortic valves, exhibit a phenomenon which has not been explained. While under the anesthetic and for some hours following, the fifth blood pressure phase, which may previously

these cases the blood pressure is a guide of great value. A frequent cause of a partial obstruction of the airway is the neck band of the patient's shirt which becomes tightly drawn across the trachea as a result of moving the patient on the table. A falling blood pressure may quite frequently be traced to dyspnea due to the weight of a surgical assistant resting on the patient's chest. The steady decline in blood pressure demonstrates

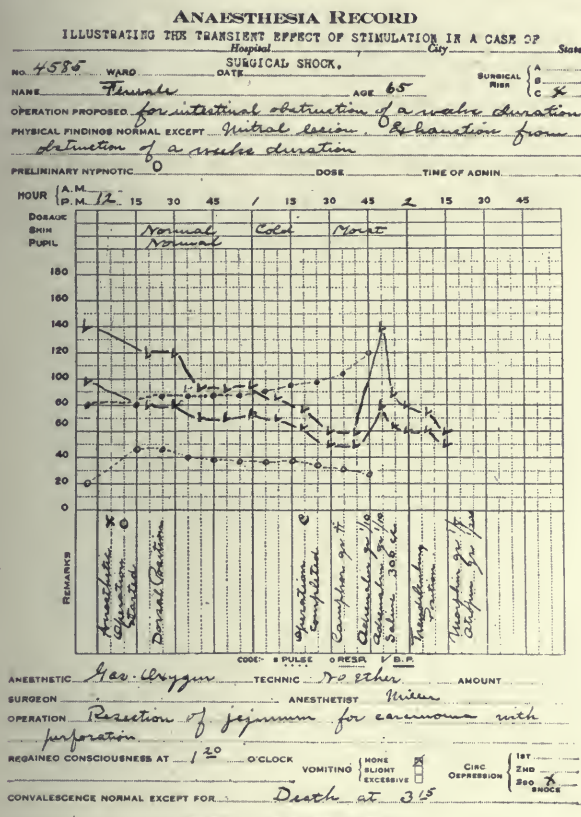


Chart 1. Illustrating the transient effect of stimulation in a case of Surgical Shock.

have shown the usual relation to the fourth, sinks to zero. As the diastolic pressure in these cases is obviously not zero, we here find a powerful argument for reading the diastolic pressure at the fourth rather than the fifth phase.

#### EFFECT OF RESPIRATORY OBSTRUCTION.

The systolic pressure varies during the respiratory cycle, being less during inspiration and greatest at the beginning of expiration. If the airway is obstructed from any cause, the variation becomes greater, amounting in some instances to 50 mm., the systolic and pulse pressures being increased, with little change in the diastolic pressure. If the obstruction persists, there is a steady fall in the systolic and diastolic pressures. Respiratory obstruction is not always immediately noticeable and the cause is sometimes difficult to locate. In

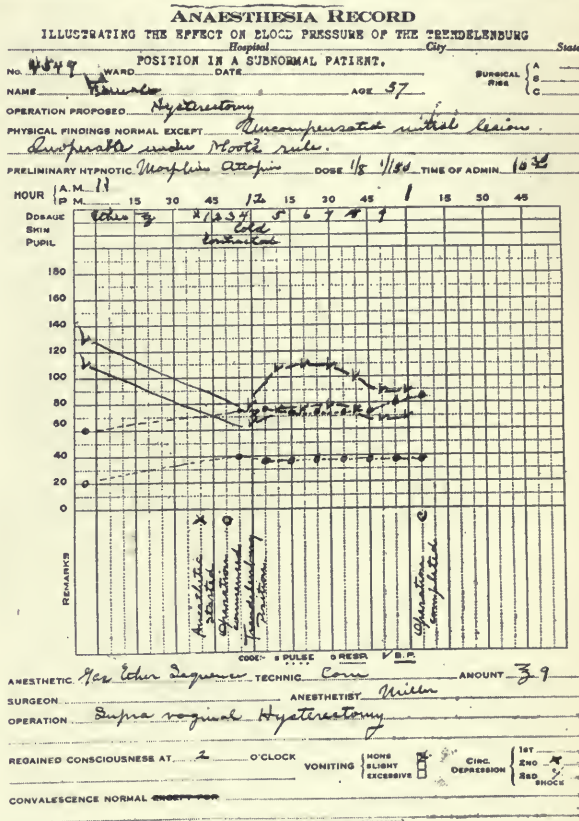


Chart 2. Illustrating the effect on blood pressure of the Trendelenburg posture in a subnormal patient.

that this is a vicious practice which must be immediately and effectually corrected.

#### EFFECT OF TEMPERATURE.

In an operating at a temperature of 50° Fahrenheit, with the exposure of viscera required for an intestinal resection, the systolic pressure declines steadily at the rate of a millimeter a minute. If the condition is recognized and the room is quickly heated, the blood pressure soon recovers. A drop in blood pressure, usually but not always transient, results from hot or cold applications to extensive visceral or muscular surfaces or from irrigation of body cavities with hot or cold solutions. In these cases the blood pressure is a warning and a guide.

#### EFFECT OF POSTURE.

A sudden change in the position of the anesthet-



ized patient results in a distinct drop in the blood pressure. In several instances the change from dorsal to Trendelenburg position has been immediately followed by a fall of 60 mm. in the systolic pressure. This change was not accompanied by an immediate effect on the pulse rate. The change from the dorsal to the prone position has an even greater effect on the blood pressure. Usually but not always this fall in blood pressure is quickly

condemned unless the patient's condition is first proved to be satisfactory by blood pressure tests.

#### EFFECT OF ANESTHESIA. I

During the induction of general anesthesia, there is frequently a rise in the systolic pressure, sometimes amounting to 30 mm. This change is transient and within twenty minutes from the beginning of anesthesia the average pressure should rest at the usual level. As the anesthesia progresses,

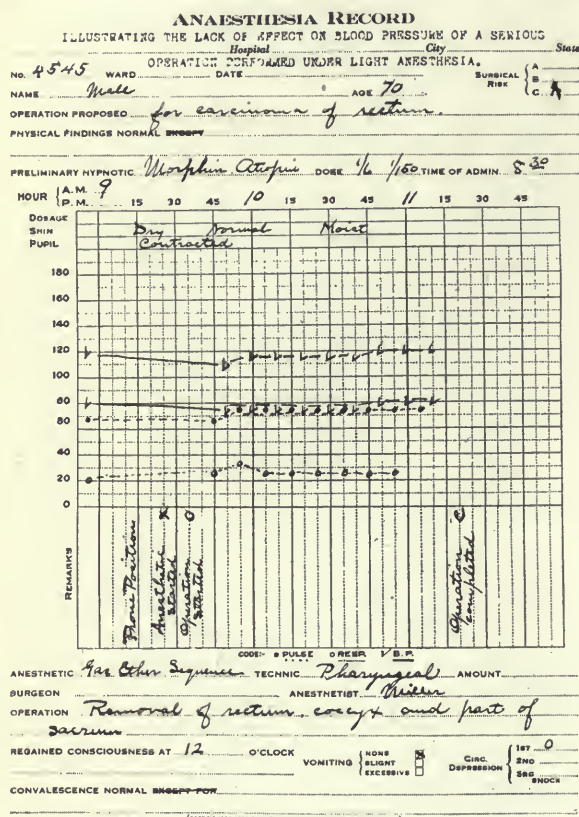


Chart 3. Illustrating the lack of effect on blood pressure of a serious operation performed under light anesthesia.

rectified. In one instance, a patient who had undergone a breast amputation was propped up in the sitting position for the application of the bandage and immediately died.

Protracted use of abnormal postures may result in serious blood pressure changes. The dorsal is the position of choice for the anesthetized patient. In the lithotomy position the systolic pressure is increased. There is a further increase if the hips are elevated. In the Trendelenburg, the reverse Trendelenburg, or the prone position the systolic pressure steadily declines. These changes are more pronounced in case the patient is profoundly anesthetized. As a result of the routine use of the Fowler postoperative posture, many patients with resistance already otherwise impaired, have undoubtedly died. The use of this position must be

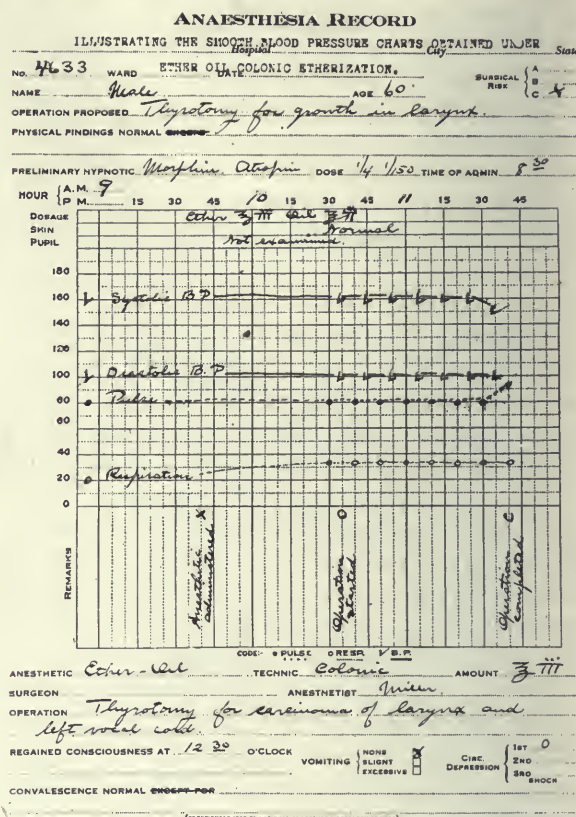


Chart 4. Illustrating the smooth blood pressure charts obtained under ether oil colonic anesthesia.

there is a steady decline in the systolic pressure but under a light degree of anesthesia the fall in blood pressure during an operation of the customary duration is so slight that it is not generally noted. A profound anesthesia is accompanied by a marked decline, affecting the systolic, diastolic, and pulse pressures.

Anesthesia may be considered under three headings; according to the effect (1) on consciousness, (2) on the muscular system, and (3) on the vital functions. The classical signs of so-called surgical anesthesia depend upon the effects on consciousness and on the muscular system and disregard the effect upon the vital functions. As a result it happens that a patient who is suffering from an overdose of the anesthetic, with a falling blood pressure, a cold skin, a profuse perspiration, and



Cheyne-Stokes respiration may still show the signs of insufficient anesthesia. Often enough a patient has died from anesthetic overdosage when the surgeon was complaining of insufficient muscular relaxation and urging the anesthetist to get the patient under. In such cases the blood pressure tests, closely measuring the effect of the anesthetic upon vital functions, become the most valuable indication of overdosage or approaching overdosage of the anesthetic. The strenuous patient may survive a tremendous overdosage but in the cases of vital depression, as from shock or hemorrhage, a slight overdosage tips the scale to the side of failure. The fatality is attributed to surgical shock but the blood pressure evidence indicates that the effect of surgical traumatism is usually negligible in comparison with anesthetic overdosage.

#### VALUE OF BLOOD PRESSURE IN OPERATIVE SURGERY.

Besides opening the interesting and important field of study which has been described, the blood pressure tests are often of great immediate value in operative surgery. In the preoperative examination; in detecting nephritis or cardiovalvular lesions, in estimating the gravity of cardiac defects, and in determining the degree of cardiac defects, and in determining the degree of vital depression from hemorrhage or traumatic shock, these tests are of incomparable usefulness. During the operation, blood pressure readings warn us of the presence of injurious factors which we aim to avoid and in unavoidable vital depression from shock or hemorrhage furnish a reliable index to the degree to which the depression may, with a fair amount of safety, be allowed to progress.

Blood pressure is our most certain guide to the condition of the circulatory system. The fact that a majority of surgeons and anesthetists overlook the importance of blood pressure tests in their work is difficult of explanation.

131 WATERMAN STREET.

THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL HOLD ITS NINTH ANNUAL MEETING AT THE HOTEL BELLEVUE, BOSTON, MASS., JUNE 6-8, THE FIRST THREE DAYS OF A. M. A. WEEK. A SPLENDID PROGRAM IS IN PREPARATION SO MAKE YOUR PLANS NOW TO ATTEND. THE A. A. A. HAS ALSO BEEN GRANTED ONE SESSION OF THE A. M. A. SECTION ON MISCELLANEOUS TOPICS FOR A PROGRAM OF ANESTHESIA PAPERS. THE A. A. A. SECTION ON OBSTETRICS WILL ALSO PRESENT A SYMPOSIUM ON ANESTHESIA.

## A DROP METHOD OF ETHER VAPOR ANESTHESIA AND APPARATUS FOR ITS ADMINISTRATION.\*

S. GRIFFITH DAVIS, M.D.,  
BALTIMORE, MD.

Neither the subject of drop ether nor that of ether vapor anesthesia is new, but the two methods in combination, with the ether vapor delivered to the patient by the force of its own expansion, an expansion brought about by its volitization, is seldom, if ever, made use of.

In 1876, J. E. Adams used the force produced by the expansion of ether to drive the vaporized ether through a rubber tube in order to deliver it to a patient for the purpose of producing anesthesia. He put ether in the reservoir of a Hawksley Medical Inhalor placed in a tin of water, kept at a temperature of 100° F. to insure volitization<sup>1</sup>. Later, Molliere used the same method to produce rectal anesthesia. He immersed the ether container in water kept at a temperature of 122° F.<sup>2</sup>

#### IMPORTANT CONSIDERATIONS.

It is not my purpose to enter into an extensive discussion of the merits or demerits of the drop or vapor methods. I hope to spend the major portion of my time in emphasizing the advisability of preparing the ether for inhalation, the importance of a continuous flow of ether of a greater or less volume, as conditions present themselves, throughout the operative procedure and to the description of a simple apparatus for the purpose.

Firmly believing that ether is by far the most important anesthetic agent we have and the least harmful, when properly administered, I have been greatly concerned as to the most efficient method of administration.

I long since discarded the closed cone method for the so-called open drop method of administering ether. I say *so called*, because the ether is dropped or more often poured on the mask at irregular intervals and quantities, at times the patient getting no ether at all, at other times being almost drowned in ether. Realizing that the open drop method, even though it may be properly administered, is rather a crude procedure, it has been my aim to devise some method by which the ether could be properly prepared for inhalation, before it is delivered to the patient.

We cannot, in my judgment, question the advisability of preparing the ether for inhalation by

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society, William Penn Hotel, Pittsburgh, October 5-7, 1920.



vaporizing and warming it to approximately body temperature; and neither can we question that there should be a continuous flow of the ether vapor, of greater or less volume, during the entire period of narcosis, in order that the narcosis may be maintained at the proper level for the operative procedure.

The dose should be as small as will permit the surgeon to do his work without disturbance, such as would be caused by the movement of the patient, contraction of muscles, vomiting, or improper relaxation. We cannot state any definite dose as suitable for all cases, neither can we content ourselves by administering a stated dose per minute throughout the various stages of the operation. The condition of the patient should be and must be the guide to indicate the amount to be given.

We know that some patients are very much more susceptible to the effects of ether than others. Just as a definite dose of morphin or even quinin will have the desired effect in one individual and a very unhappy result in others; and as a different result may occur in the same individual under different conditions, so it is also with ether, some patients take a much larger dose than others to produce the desired results and some patients take more or less under different circumstances.

#### VALUE OF WARMED VAPOR.

At the time I developed my copper coil warming apparatus in 1909, while demonstrating it to Dr. Harvey Cushing, his first remark, upon inhaling the warmed ether vapor, was "it is not nearly so irritating to the respiratory tract as the cold vapor."

Dr. Albert H. Miller states that cold ether vapor is much more irritating to the respiratory passages than the same vapor is when warmed. He also states that one can readily inhale a concentrated ether vapor at 95° F. while the same vapor at 45° F. is irrespirable by any conscious person.<sup>3</sup>

On one occasion while using a wash bottle device for the administration of ether vapor, through a nasal tube inserted in the nasopharynx, the surgeon introduced his finger into the nasopharynx, after the removal of the tonsils in order to palpate for adenoids. As he did so, he exclaimed "it feels like an icehouse in this patient's throat."

It has been my experience that patients respond to the effect of the warmed vapor very much more rapidly than the cold and likewise recover in a much shorter time. I have frequently observed a difference in the action of the pupils under the two conditions. Using warm vapor, I find upon carrying a patient to the stage of true surgical narcosis (the pupils being normal in size and activity), the

narcosis can be brought to the beginning of the fourth stage with a widely dilated fixed pupil in a much shorter time and with less ether than with cold vapor, and also that the pupils resume their normal state much more promptly.

With the open drop method, it is very difficult to carry out an experiment which will indicate the actual temperature of the inspired ether vapor and air, as the temperature under the mask varies so greatly with each expiration and inspiration. It likewise varies greatly with the patient breathing atmospheric air alone at the temperature of the operating room. However, with a chemical thermometer carefully adjusted under the mask, so that it does not come in contact with the gauze covering, but is so arranged that only the current of inspired and expired gases come in contact with the thermometer, an approximate temperature can be ascertained.

With the patient simply inhaling the atmospheric air through the inhaler, a mean temperature of 34.5° C. was observed, with the addition of ether on the mask, the mean temperature at times was found to be approximately 21.5° C., showing a difference of 13° C. caused by the refrigerating effect of the ether. This refrigeration is very much increased when the gauze, covering the mask, is oversaturated. It is quite evident that a temperature far below this would be produced by drawing a current of air through several layers of gauze, which are saturated with ether and frequently covered with frost, or indeed at times frozen stiff. Under such conditions, the patient would probably be drawing gases into the air passages which have been cooled to approximately the freezing point of water.

With the patient inhaling the atmospheric air and ether vapor prepared by the apparatus, which I will describe later, a mean temperature of 34.5° C. was observed under the mask. This is precisely the temperature observed with the patient inhaling the atmospheric air alone. Therefore, it seems to me, that it is far better to prepare the ether before inhalation by vaporizing it and warming it to approximately body temperature.

#### DESCRIPTION OF APPARATUS.

I wish to picture an apparatus, simple, small and easily portable, used by me, almost to the exclusion of other methods, for two and a half years. This apparatus may be described briefly, as consisting of two portions, first: an ether reservoir or dropper, secondly: a vaporizer and warmer.

The ether reservoir is made from a No. 4 Royal Oil Cup, so modified as to make a most efficient



ether dropper and which can readily be used for dropping ether upon a mask,, when the open drop method is employed.

It was found that the cork gaskets at the end of the glass cylinders, in the reservoir and the sight

that one can readily ascertain the amount of ether used, at any period of the administration, and can also, by observing the ether drops passing through the sight feed, note the rate at which the ether is



Fig. 1. Author's Apparatus for Drop Ether Vapor Anesthesia, ready for use.

feed, were soon destroyed by the action of the ether, consequently, it was necessary to find some substance more suitable for the purpose. Dental cement answers the purpose most satisfactorily and forms a secure joint between the glass and the metal.

The glass of the ether reservoir is graduated so

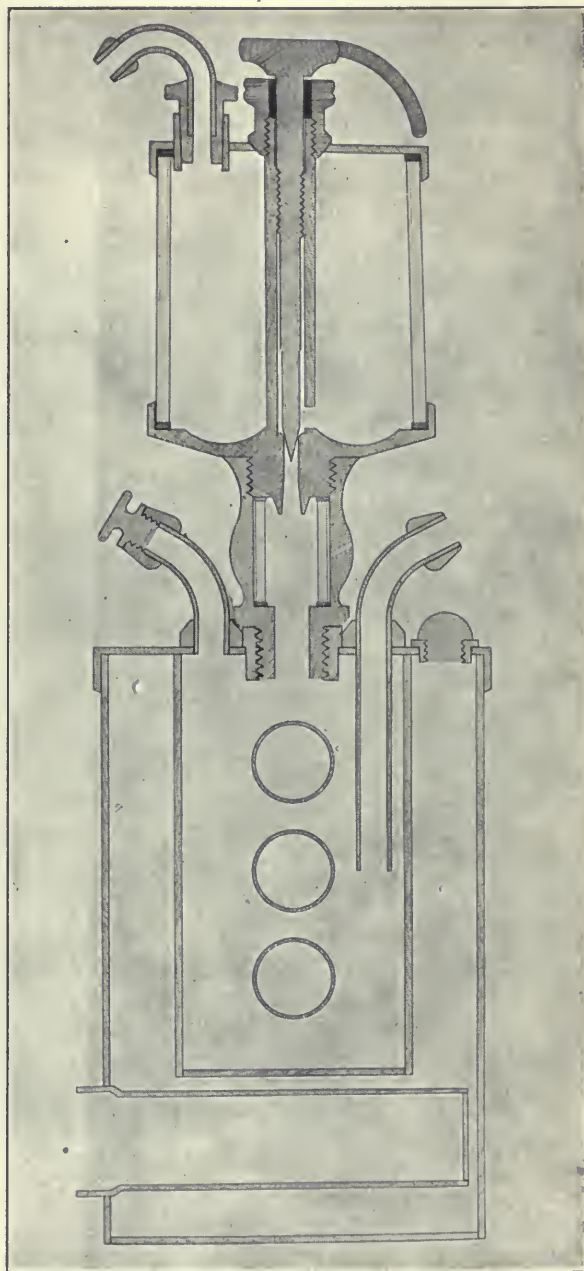


Fig. 2. A vertical section showing the various portions of the apparatus.

being delivered to the patient at any period of the operation.

A packing box was constructed around the stem of the needle valve, in order that the space above the ether could be rendered air tight. The packing also causes slight resistance to the movement of the needle valve.



The opening in the metal top of the reservoir was enlarged and guarded with a perforated plug, terminating in a nipple for the attachment of a rubber tube, for the administration of gas and oxygen, as well as oxygen alone, or with ether.

Upon the upper surface of this top, a dial is marked off, with markings at intervals of half an inch, beginning at 0 and terminating at 5, with a half-mark between each number. An indicator was made to extend from the shaft of the needle valve to the circumference of this disc, so arranged that



Fig. 3. (A) Shows the vaporizing chamber with the cross tubes. (B) Water-Jacket with electric light bulb partly withdrawn and clamp for locking the bulb in place; also hooks for attaching apparatus to operating table.

when the valve is closed, the indicator is pointing at 0 and when moved to 1, the ether just begins to drop, the flow increasing as the indicator is moved forward, until 5 is reached, at which point the ether flows in a continuous stream of small volume. The ether passes through a sight feed, where the rate of drops can be observed by the eye, as they drop into the vaporizing and warming chamber, where the ether is prepared for inhalation.

The vaporizer and warmer may be described as made up of a central chamber, and about 4 inches in length, a cross-section of which is elliptical, the long axis being 2 inches, and the short axis 1 inch. Passing across this chamber are three tubes, open at the end and terminating in a water jacket, which surrounds the central chamber.

The central chamber is completely surrounded by water, except at its upper end, consequently there is no possibility of the ether vapor being heated to a temperature sufficient to form acetic aldehyde.

Such an accident happened to me on one occasion while using an intratracheal apparatus, but fortunately, it was detected by the pungent odor before the introduction of the tracheal tube.

The cross tubes are for the purpose of giving a greater radiating surface for the evaporation of the ether, with a minimum amount of heat. They are so arranged, one above the other, that the ether dropping into the chamber lands upon the uppermost tube and gradually trickles down from tube to tube until it is all vaporized.

The ether vapor escapes from this chamber through an efferent tube, which starts within the

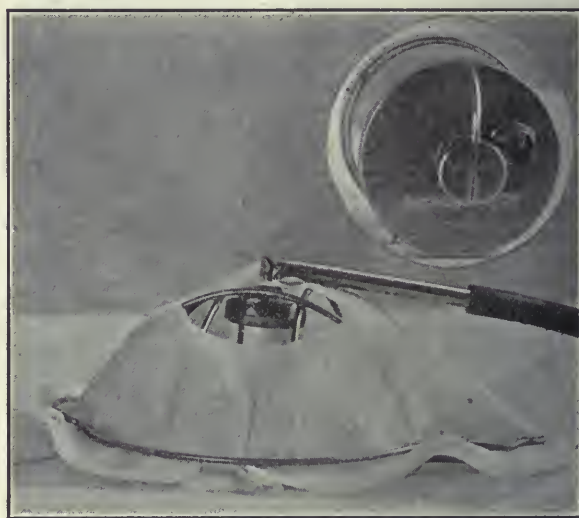


Fig. 4. (A) Shows dial on top of ether chamber; head of needle valve indicator and opening for filling ether chamber. (B) Mask with portion of gauze torn away showing arrangement of the distributor in the top of the mask.

chamber at the level of the central cross tube and terminates externally in a nipple for the attachment of a rubber tube, which conveys the ether vapor to the mask.

A clinical thermometer inserted in the distal end of this tube and so arranged as not to touch the sides of the tube, nor obstruct the free passage of the ether vapor from the tube, will register 35° to 39° C. according to whether the vaporizer is very hot or only sufficiently warm to vaporize the ether. The temperature of the vapor also varies, according to the rapidity of its flow. Of course, the more rapid the flow, the warmer the vapor.

There is also a short tube connecting the central chamber with the outside air, which is only used when gas or oxygen is administered with the ether or when oxygen alone is given through the apparatus. This tube is closed while giving ether alone, or may, of course, be attached to gas or oxygen cylinders.



Passing in to the side of the water jacket is another tube, closed at the inner end and of sufficient size to admit a small electric light bulb or electric coil, for the purpose of heating the water to the required temperature. The little bulb is used, because it is a simple matter to pull it out at any time to see if the heating apparatus is in working order, hence it is more satisfactory than an electric coil.

The ether vapor is conveyed through a rubber tube, about 15 inches in length to a distributor, which is placed in the crown of the mask. The distributor is made of a  $\frac{1}{4}$ -inch metal tube, about 3

gauze, layed directly over the patient's face. I prefer a wire frame mask patterned very much after the Esmarch chloroform inhaler made larger to give greater space under the gauze, for the mixture of air and ether. I have found the air space should have a capacity of approximately 400 cc. The most suitable covering for this frame is eight layers of ordinary hospital gauze. Other substances, such as stockinet or thin flannel may be used.

#### REGULATING THE HEATING OF THE APPARATUS.

This apparatus will not perform its duty unless kept warm. As the boiling point of ether is  $35^{\circ}$  C.

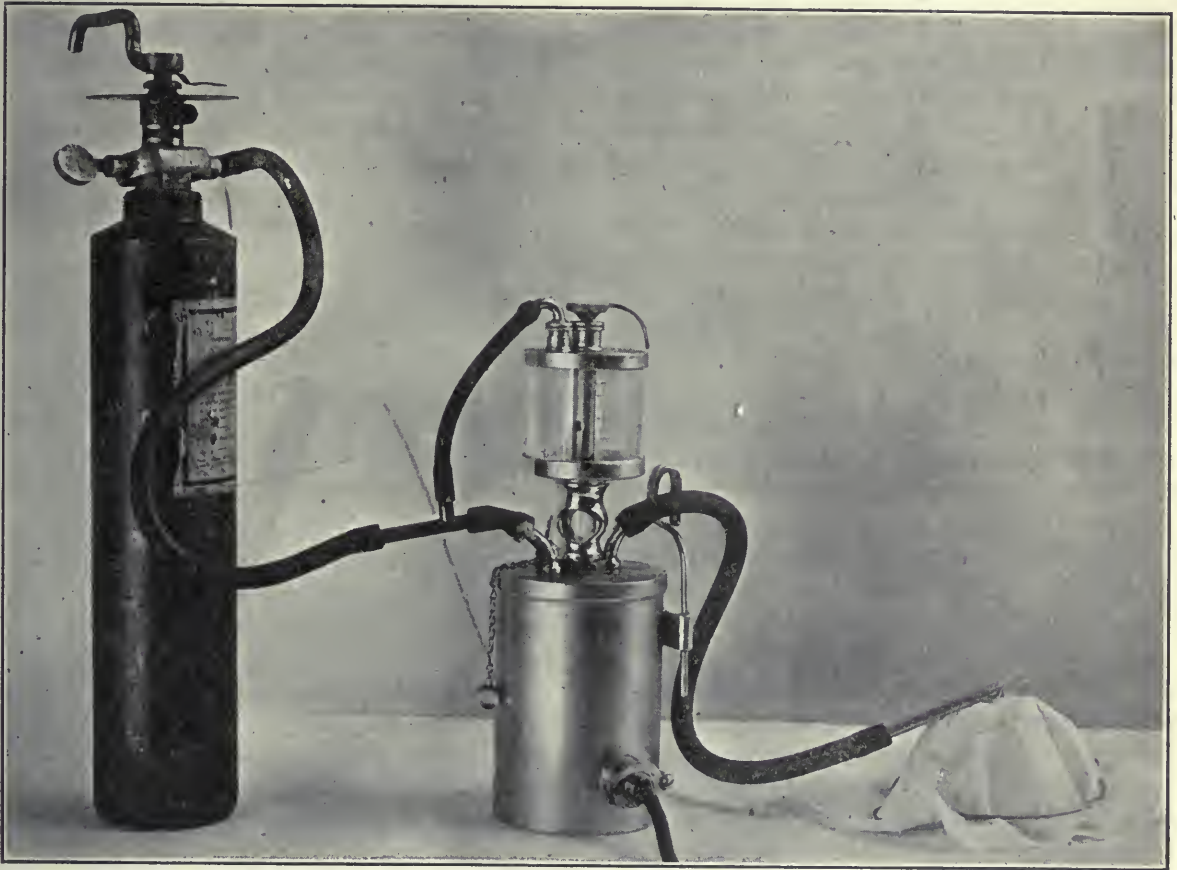


Fig. 5. The apparatus as set up for the administration of nitrous oxid-oxygen in combination with ether.

inches in length, bent at right angles near its inner end and terminating in a hollow disc  $\frac{1}{4}$  inch in thickness and 1 inch in diameter, the circumference of which is perforated by a number of holes  $\frac{1}{8}$  inch in diameter. These holes are in a plane directly parallel to the under surface of the crown of the mask and direct the current of ether vapor in all directions, thus insuring a thorough mixing with air before inhaling.

The stem of this distributor passes through the gauze covering the wire mask and can be used with any form of mask or with simply a few layers of

it is necessary that the water in the jacket be maintained at a temperature of  $40^{\circ}$  or  $50^{\circ}$  C. If less than  $40^{\circ}$  the ether will not vaporize promptly drop by drop as it enters the chamber and there may be an accumulation of excess liquid ether. On the other hand, if heated above  $50^{\circ}$  the ether in the reservoir may boil. This, however, is not a serious condition but a waste of ether.

The actual temperature can be ascertained by inserting a chemical thermometer through the opening leading into the water jacket, by which it is filled. For all practical purposes a temperature



feeling hot to the hand and not too hot for comfort will suffice.

The ordinary method of heating the apparatus, preliminary to use, is to set it in a vessel containing boiling water. Here it will heat to the desired temperature in about one minute. If we do not have boiling water available, a gas or an electric heater may be pressed into service. When heated by the electric light alone, it takes approximately fifteen minutes to reach the proper temperature for use.

#### THE METHOD OF PROCEDURE FOR ETHER ANESTHESIA.

With the apparatus heated and in readiness, the mask is adjusted over the patient's face, as for the open drop method. The mask is loosely covered by an open towel, which acts somewhat as a diaphragm, slightly inhibiting the mixture of the respiratory gases from the lung and the atmospheric air, consequently this would be a semi-open method of administering ether.

The indicator, standing at 0 is gradually moved to 1, at which point the ether begins to drop slowly, then it is gradually moved to 2, 3, 4 or 5, as necessary, according to the response or the resistance of the individual. For a child 2 will suffice. For a robust adult, it is frequently necessary to carry the indicator to 5 or at times beyond. Great care should be exercised not to increase the drops too rapidly, as there will be great danger of producing irritation to the membranes of the throat and larynx, causing the patient to cough and prolong the period of induction and also cause a flow of mucous and a wet throat, which may give us a great deal of trouble during the narcosis.

At times, it is advisable to administer oxygen with the ether or oxygen alone. It is a very easy matter to connect the apparatus, by means of a rubber tube, to preferably a low-pressure oxygen tank; or if this is not available, to a high-pressure tank with a reducing valve, which can be pressed into service, and the oxygen is allowed to flow through the warming chamber and is there mixed with the ether continuously dropped in from the ether chamber, the rapidity of the drops being accurately controlled by a needle valve. Thus we have the situation well in hand, oxygen as desired, either with or without the ether.

By preference, I start my anesthetics by the gas-ether sequence, using the semi-open method, as with the administration of ether alone. The apparatus is connected by a tube with a nitrous oxid tank, and, if desired, also an oxygen tank. The anesthesia is started with gas by the semi-open method; that is the towel is loosely thrown over the

mask in order to limit the escape of gas into the atmosphere and to cause a limited amount of to and fro breathing. As an increase in rate of respiration is observed, the ether is gradually turned on, exercising the same great care, not to increase the flow to such a degree as to cause irritation to the mucous membrane of the throat and larynx, gradually to 4 or 5, according to the respiration, hold at this for ten or twelve respirations, then gradually cut down the flow of gas, finally discontinuing the gas and proceeding just as with the ether alone.

#### ADVANTAGES OF THE APPARATUS AND METHOD.

The advantages of an apparatus of this sort are very great and may be somewhat summarized as follows:

1. The ether is prepared for inhalation by being vaporized and warmed to approximately the normal temperature of the body before inhalation; also any oxygen or gas that may be used are warmed.
2. Economy from the viewpoint of not requiring as much ether as do some of the other methods to produce the desired degree of narcosis.
3. It gives a steady and continuous supply of ether regulated by drops, accurately controlled by a needle valve.
4. It gives the anesthetist more time to observe the condition of the patient and really gives him one hand free for whatever use it may be required.
5. The apparatus is very simple, easily portable and can be hung on or attached to any operating table, out of the way of the operator and his assistants.
6. The anesthetist can easily keep from coming in contact with the field of operation, the surgeon or his assistants, during an operation upon the upper portion of the body. This is of especial advantage in such cases as breast amputations, dissections of the neck and various cranial operations.

#### DISADVANTAGES.

I do not think it quite fair to point out the advantages of this apparatus, without calling your attention to some of the disadvantages.

1. When we mix up an electric current with such a volatile substance as ether, there is, at times, danger of the ether vapor becoming ignited, unless the wires are perfectly insulated. Indeed, this occurred to me upon one occasion. The wire happened to break just at the moment I was pouring ether into the ether chamber. Some of the ether happened to run over just as my wire gave way. There was no harm done, except the patient's right ear was slightly burned, and a few towels destroyed.
2. This apparatus has not been very successful in operations where it was necessary to conduct the



ether vapor by a tube directly into the nose, nasopharynx or trachea, as the concentrated ether vapor is too irritating for the sensitive membrane of the larynx, and is apt to cause the patient to cough unless he is profoundly anesthetized.

1230 LIGHT ST.

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### PRIMARY AND SECONDARY NITROUS OXID SATURATION AS A TEST FOR DETERMINING THE CAPACITY OF THE PATIENT FOR OPERATION.\*

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*Editor's Note: In a previous issue of the Supplement, (October, 1920) Dr. E. I. McKesson detailed at length the fundamental physio-pathology and technic of primary and secondary nitrous oxid saturation for relaxation. More recently he has found this advance in pure nitrous oxid-oxygen anesthesia a valuable test for determining the capacity of the patient for operation. Dr. McKesson was awarded one of the N. A. R. S. first prizes for his complete presentation of his researches at the Pittsburgh meeting.*

We are occasionally asked to anesthetize patients who may be regarded generally as inoperable. Without the contemplated operation death may be inevitable and with it more than probable. If the patient is unable to withstand the burden of beginning narcosis, the operation, ordinarily must be abandoned forthwith.

The question therefore arises as to how we may more surely determine that the patient will succumb during, or immediately after operation. How can we avoid the hopeless cases without abandoning any patient who might be given the benefit of operation with some prospect of cure? The answer to this question is difficult and depends upon many factors aside from the resistance of the patient, the duration and character of the operation, the surgeon, the anesthetist, the anesthetic and the use of other measures calculated to prolong life. It is a delicate situation in which any one member of the surgical team may cause disaster on the table; and in which even the most intelligent cooperation

of all concerned may not be able to avoid a fatal outcome.

You cannot tell by the looks of a frog how far he can jump. Nor will mere inspection or even routine examination of extra hazardous risks, however valuable, always give more than a vague surgical prognosis.

The pulse may not be extreme in rate, the blood pressure may be shamming. The real question is: How much reserve have we to draw upon; or will slight interference break the delicate balance of pulse, blood pressure and respiratory relations and initiate an immediate demise?

Several years ago I was called into the country to anesthetize a farmer who had had a strangulated hernia for several days and was apparently very near death. After carrying him from his bed to the kitchen table he had to be resuscitated with oxygen. In inducing anesthesia I did a primary saturation with nitrous oxid-oxygen and was compelled to again resuscitate the patient with oxygen, which was easily accomplished. The surgeon then suggested the use of ether on the supposition that ether is a stimulant even in anesthetic dosage. A few drops of ether were administered and after 15 minutes' work with oxygenation the patient was sufficiently resuscitated to be put back to bed without being operated on. The patient died four hours later. And we concluded that this patient was inoperable.

When a normal pulse rate is reduced the blood pressures normally fall from 25 to 50 per cent. of the difference in the pulse rate, and conversely when the pulse rate increases the blood pressures rise. A patient who has a pulse rate of 120 or over may develop a slower heart beat under anesthesia with a slight increase of blood pressures or the pressures may remain stationary while the pulse rate becomes slower. Such a condition is a good omen and not an indication of circulatory depression. When changes in pulse rate are not accompanied by the above mentioned changes in blood pressures we have some degree of circulatory depression.

Primary and secondary nitrous oxid saturation, at one phase, increases the pulse rate and immediately following decreases the pulse rate and blood pressures. When the oxygen reaches the blood stream a moment later the pulse rate and blood pressures return immediately to their former readings. This is the normal response to nitrous oxid saturation and reoxygenation.

Now in the moribund case we usually have circulatory depression of a more or less serious degree to begin with, and the effects of primary nitrous

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists, in conjunction with the National Anesthesia Research Society, the Western Pennsylvania Odontological Society and the Medical Society of the State of Pennsylvania, William Penn Hotel, Pittsburgh, October 5-7, 1920.



oxid saturation followed by a breath or two of oxygen may show an increased circulatory depression lasting from 3 to 5 minutes, and this response to the test when present, contraindicates any but extremely short and simple operative procedures.

In questionable cases, in which the patient's reserve is seriously in doubt, and in which an abdominal or some other major operation is contemplated, a deeper and more searching test is needed to determine the reserve or compensatory powers which the patient must have to go through with the surgical procedure safely. For this purpose I have many times resorted to primary and then secondary nitrous oxid saturation, noting the effect of each on the pulse rate and blood pressure relations for from 3 to 5 minutes after reoxygenation. If the pulse is increased as much as 25 per cent. and the blood pressures are decreased 25 per cent. or more, establishing second degree circulatory depression, and the patient while inhaling oxygen is unable to compensate within 5 minutes, he may be regarded as absolutely inoperable for major surgery in the hands of the best organization of surgeon, anesthetist and assistants.

The personal factor enters into saying "yes" or "no" to a proposed operation. Patients are being shocked to death every day who would easily pass the saturation test as I have detailed it. The anesthetist must properly rate himself as well as the surgeon and assistants not to mention the patient, denying none who might live if operated upon and refusing all those who will die during surgical procedures.

I have had no deaths or serious scares as a result of either primary or secondary nitrous oxid saturation for relaxation or as a test for determining the capacity of the patient for operation. The use of the test has enabled me on several occasions to eliminate inoperable patients who shortly afterwards died from the effects of their pathological conditions without operation.

My conclusion, therefore, is that primary and secondary nitrous oxid saturation in relation to the pulse rate and blood pressure ratios, makes a valuable and safe test of operability in doubtful risks and moribund cases.

2236 ASHLAND AVE.

## STUDIES IN THE EFFECTS OF NITROUS OXID-OXYGEN ANESTHESIA ON ANIMALS INFECTED WITH TUBERCULOSIS THROUGH THE RESPIRATORY TRACT.\*

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CINCINNATI, OHIO.

Due to the great prevalence of pulmonary tuberculosis, an anesthetic that can be used for operative procedures on tuberculous individuals, without producing injury to them, is greatly needed. Only during the last few years has it been fully recognized that a rapid spread of the disease often followed operations on the tuberculous under ether anesthesia, and for this reason clinicians treating cases of tuberculosis generally advised against surgery except under extreme circumstances.

### PATHOLOGIC CHANGES FOLLOWING ETHER ANESTHESIA.

From the work of Corper<sup>1</sup>, Brown and Petroff<sup>2</sup> and Rogers<sup>3</sup> it can be seen that repeated ether anesthesia on tuberculously infected animals does not result in a more rapid spread of the disease process. The conclusion seems warranted that the detrimental influence of ether anesthesia results from factors purely mechanical and the following explanation is suggested: From the work of Dunham<sup>4</sup> it seems established that the spread of chronic tuberculosis through the lungs, with fatal termination of the disease, comes largely, if not entirely, as a result of aspiration from the apical lesion, usually a cavity, to the larger areas of the lung substance, causing aspiration bronchopneumonia and after a few months death. Any factors such as labored respiration or excessive body movements aid in this aspirating process.

Ether anesthesia not only causes labored respiration but increases the secretions diluting the infectious, germ-laden sputum and in this way causes a general spreading of the disease germs.

In the laboratory animal, the disease is anatomically different, inasmuch as the chronic ulcerative form is not present, but more of a solitary tubercle formation without ulceration, hence the aspirating of infectious material does not occur.

\*Read during the Sixth Annual Meeting of the Interstate Anesthetists, in conjunction with the National Anesthesia Research Society, the Western Pennsylvania Odontological Society and the Medical Society of the State of Pennsylvania, William Penn Hotel, Pittsburgh, October 5-7, 1920. From the Percy Shields Memorial Research Laboratory, Cincinnati Tuberculosis Sanatorium and the Department of Bacteriology, University of Cincinnati Medical College. The gases used in these experiments were kindly furnished by the Ohio Chemical Co., through Max Woehner and Son of Cincinnati. This paper was awarded one of the \$25 N. A. R. S. prizes for merit in anesthesia research.



## NITROUS OXID ANESTHESIA.

Since the less irritating gases, nitrous oxid and oxygen, have been universally employed as an anesthetic, it is only natural to turn to them when searching for an anesthetic to use on patients with respiratory diseases. At the suggestion of Dr. F. H. McMechan, chairman of the N. A. R. S. Research Committee, I have undertaken some experiments to determine the effect of the above mentioned gases on laboratory animals, artificially infected with tubercle bacilli. However, as stated before, animals rarely develop the chronic ulcerative type of tuberculosis analogous to that found in the human being. For this reason an exact compari-

inary sensitization, all animals were infected through the respiratory route, using the following method: Each pig was wrapped in thick cloth, leaving only the nose exposed. All the pigs were then placed in a wooden box with a glass top through which the animals could be observed. The box was then snugly closed with adhesive plaster, leaving only a small opening at one end, large enough to insert the nozzle of a No. 15 De Vilbiss Atomizer, which contained a watery emulsion of virulent human tubercle bacilli recently taken from an active, open case of tuberculosis. Twenty-six animals were thus kept in an atmosphere of finely atomized solution of the organisms for three min-

TABLE I.—ANESTHETIZED GROUP.

*Note.*—The lesions were marked from + to +++++, + denoting the minimum and +++++ the maximum involvement.

<i>Animal</i>	<i>Emaciation</i>	<i>Lungs</i>	<i>Liver</i>	<i>Spleen</i>	<i>Glands</i>
1.	Moderate	+++++	+++++	Negative	+++++
2.	Moderate	+++++	+++++	++	++
3.	Moderate	++	+++++	Negative	++++
4.	Moderate	+++++	+++++	+++++	+++++
5.	Moderate	+++	++	Negative	+++++
6.	Marked	+++++	++	Negative	+++++
7.	Moderate	+++++	++	Negative	++++
8.	Moderate	+++	+++++	+++++	++
9.	Moderate	++	+++++	+++++	++++
10.	Moderate	+++++	+++++	+	++

TABLE II.—CONTROLS.

<i>Animal</i>	<i>Date of Death</i>	<i>Findings</i>
1.	8-12-20	Generalized tuberculosis
2.	8-16-20	Generalized tuberculosis
3.	8-28-20	Generalized tuberculosis
4.	8-29-20	Generalized tuberculosis

TABLE III.—CONTROLS.

<i>Animal</i>	<i>Emaciation</i>	<i>Lungs</i>	<i>Liver</i>	<i>Spleen</i>	<i>Br. Glands</i>
1.	Marked	+++++	+++	+	+++
2.	Moderate	+++++	+++	+	+++++
3.	Moderate	+++++	+++	—	++
4.	Moderate	+++++	+	+	+++++

son cannot be made, and the only question that can be answered is whether or not these gases will hasten or retard the development of the tubercle or otherwise influence the general health of the animal.

## EXPERIMENTAL INVESTIGATIONS.

EXPERIMENT I.—Thirty-seven male guinea pigs, weighing approximately 450 grams, were used. In an effort to stimulate human tuberculosis as far as possible, they were first sensitized by injecting them with an avirulent culture of human tubercle bacilli, (a suitable culture was obtained from Dr. W. B. Wherry); this strain having lost its virulence after more than 800 transplants. Following the prelim-

utes on 7-29-20, (11 had previously died from pneumonia.) They were then unwrapped and given a 1-5000 bichloride bath and placed in dry cages, and divided into two groups of 13 each.

*Group I.*—Beginning 24 hours after infection, the animals in this group were put in a closed wooden box and given nitrous oxid until complete anesthesia was obtained. When the respiration became labored, oxygen was given in sufficient quantities to restore normal respiration. They were kept under the anesthetic about 15 minutes each day for nine successive days. During this time not one of the animals was lost as a result



of the gases, and three died from epidemic pneumonia. On 8-29-20 all pigs were killed and dissected, and the results are shown in Table I.

*Group II.*—The animals in this group were used as controls and not molested after infection. Five of them died from pneumonia before the disease developed, and of the remaining 8, 4 died later and were examined. For results, see Table II. The remaining 4 were killed with those in the anesthetized group and the findings recorded in Table III.

EXPERIMENT II.—Ten adult male guinea pigs were infected on 8-17-20 as in Experiment I. These were divided into two groups, one group of seven for anesthesia and the other three as controls. On 9-1-20 the gas anesthesia was begun and repeated daily until 9-16-20 when all pigs were killed and dissected, with the results as shown in Table IV.

#### CONCLUSION.

1. Nitrous oxid-oxygen anesthesia, administered daily to guinea pigs suffering from pulmonary tuberculosis, does not influence the development of the disease, neither is it detrimental to the general health of the animal.

2. Since these gases do not cause as much labor in respiration and are less irritating than ether, they can be considered more suitable for anesthesia, when used in cases of pulmonary tuberculosis and other respiratory diseases.

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TABLE IV.—ANESTHETIZED GROUP.

Animal	Emaciation	Lungs	Liver	Spleen	Br. Glands
1.	Moderate	++++	++++	++++	+++
2.	Moderate	++++	++++	++++	++++
3.	Marked	++++	++	+++	+++
4.	Moderate	++++	++	+++	++++
5.	Marked	++++	++++	++++	+++
6.	Moderate	++++	++++	++	++++
7.	Moderate	++++	++++	++++	+++

TABLE V.—CONTROLS.

1.	Moderate	++++	++++	++	+++
2.	Moderate	++++	++	++	++++
3.	Moderate	+++	++++	++++	+++

#### DISCUSSION.

Twenty guinea pigs, suffering with pulmonary tuberculosis, were given repeated nitrous oxid-oxygen anesthesia. In Experiment I, eight of the thirteen controls died from pneumonia before the experiment was completed, while only three of the thirteen nitrous oxid treated died during the experiment. Of the four controls which died after fourteen days, all showed tuberculosis of the lungs, liver, spleen and bronchial glands. When the ten treated and the four remaining controls were dissected thirty days after infection, no difference could be noted in the anatomic distribution or extent of tuberculous involvement.

In Experiment II, the disease was permitted to develop fourteen days and the animals then treated with the gas each day for fourteen days. Immediately following the last anesthesia, both the experimental and the control animals were killed and sectioned. As seen in Tables IV and V there was no difference in the amount of involvement in the anesthetized and the control animals.

3. ROGERS, J. B.: Studies of the Effect of Ether on Experimental Tubercle Bacillus Infections. *The Ohio State Medical Journal*, July, 1920, XVI, p. 509.

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THE INTERSTATE ASSOCIATION OF ANESTHETISTS WILL HOLD ITS SEVENTH ANNUAL MEETING WITH THE CANADIAN SOCIETY OF ANESTHETISTS AND THE ONTARIO MEDICAL ASSOCIATION, AT THE CLIFTON HOUSE, NIAGARA FALLS, JUNE 1-3. THIS WILL BE ONE OF THE MOST IMPORTANT AND ENJOYABLE MEETINGS OF THE YEAR. THE NEW YORK SOCIETY OF ANESTHETISTS IS BEING ASKED ALSO TO PARTICIPATE. THERE WILL BE A JOINT SESSION OF ALL THE ORGANIZATIONS ON THE LAST AFTERNOON OF THE MEETING. AN ATTRACTIVE SCIENTIFIC PROGRAM IS BEING DEVELOPED, SEVERAL SESSIONS OF WHICH WILL BE DEVOTED TO FUNDAMENTAL RESEARCHES IN THE PHYSIO-PATHOLOGY OF ANESTHESIA. ANOTHER FEATURE OF THIS MEETING WILL BE A SESSION DEVOTED TO CASE REPORTS OF UNUSUAL ANESTHETIC EXPERIENCES. AS USUAL, THE VISITING LADIES WILL BE DELIGHTFULLY ENTERTAINED.



## THE PSYCHOLOGY OF MUSIC IN RELATION TO ANESTHESIA.\*

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The public promotion of new ideas demands endless reiteration. Repetitions must be continuous and long maintained. At last, by the action of certain psychological sequences, people begin to suppose that these ideas are their own, and that the advocate is the platitudinarian. As Dr. Salee has said, "it is only after having long thought him mad, they think him dull, that he may congratulate himself on having done his work." This is true from the deepest science to the art of dress.

Less than one hundred years ago, surgery was considered a desperate remedy for desperate diseases. Two chief enemies existed, (1) pain and (2) inflammation. The introduction in 1847 of the use of anesthesia (nitrous oxid, ether, chloroform) and the introduction in 1868 of the use of antiseptics (carbolic acid) made possible many operations never undertaken before. It made possible a complete relaxation of the muscles, it allowed the surgeon a new attitude on the question of time. He might use two, three or four hours on a task, when a few minutes would see the end of the endurance of the patient. It prevented the patient from dying from the immediate shock and his powers of resistance were less impaired by the painless operation.

## TRADITIONAL EFFICACY OF MUSIC.

Many old traditions tell of the effective power of music, showing if nothing more, the faith which has been laid in it since early times and by many peoples. In Arabian history we find the story of a certain Alfarrabi. During the ninth century, Alfarrabi learned the art of music in Spain. So proficient did he become that his fame spread far into Asia. A distant Sultan Feber-ed-doula sent messengers bearing rich gifts to bring Alfarrabi to his court. Fearing that he might not be allowed to return to his native land, Alfarrabi refused. Finally, however, he decided to go incognito. In his tattered costume, the stranger was refused admission, but finally when he said that he was a musician who wished to gain a hearing, he was admitted. Scarcely had he begun, when all the court was seized with a fit of laughter, which not even the presence of the sultan could check. Alfarrabi then

changed the mode and immediately sadness succeeded the joy. Tears, sighs, groans took the place of the noise of the laughter. Suddenly the singer once again altered his melody and rhythm, this time evoking in his audience such a fury of madness that they would have hurled themselves upon him, if a new change of mode had not appeased them, and while they were thus plunged in a deep slumber, Alfarrabi had time to get out of the palace and away from the town before they had a chance to follow.

## THE PROFESSIONAL ATTITUDE TOWARD THE VALUE OF MUSIC IN MEDICINE.

I belong to a family of professional men—my father and three brothers all being doctors. I have grown up amidst medical and surgical discussion and table-talk; and have come to look upon the facts from a scientific, business-like attitude, even apart from my own scientific training in psychology and biology. It is therefore not my purpose to lead you into flights of fancy or artistic interpretation. Neither is it my rôle to plead the cause of music for art's sake. The thing I am interested in is the use of art—of music in the practical situations of life—and particularly today in its possibilities as an aid in a very specific situation, namely medicine.

Many physicians, particularly psychiatrists, have recorded in some casual manner the effect of music in their work. Dr. Petersen, the Dutch physician, asserted in convalescent cases that music is beneficial in inducing natural sleep and pleasant thoughts. To quote, "Music is a valuable agent to employ the patient, to lead his thoughts into definite channels, to improve his disposition. Orchestral music comes into prominence in fostering mutual kindness of disposition, provoking a friendly co-operation and an interest in the patient's surroundings and furthering the progress towards a better social bearing."

From Dr. Drapes, an Irish physician, I quote the following: "Nothing cheers patients like music; removes depression, assuages grief, quiets excitement; rarely, if ever, does it produce the slightest ill effect."

Many of you know of the Guild of St. Cecelia, founded in London in 1891 and its allied association in New York, which latter died from lack of supporting funds.

Twenty years ago music was introduced on Ward's Island with the melancholia cases. Among other observations is the following: "After musical treatment, patients were less disturbed through the night—and the results showed that the calmativ effect was at least prolonged for some time." Ac-

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cording to the records, 72 per cent. of the cases were benefited by the music.

In comparison with more modern methods of technic, and of measuring results, these statements may seem unreliable, but they at least indicate the belief on the part of the users that the music was of certain aid.

At about the same time, a Dr. Corning of New York City reported in the *Medical Record* (Jan. 21, 1899) some experiments of his own, attempting to explain the basic effect of music which as he says "we translate by vague terms—joy, sadness, serenity, or tranquility." He rigged up a hood device covering all of the face, so as to keep out all sounds except those intended, and then by means of tubes connected the ears with an Edison phonograph. He concluded that the participation of consciousness was not essential—that large areas of the cerebrum were affected and that the results were beneficial. He felt that his work was just a touch towards opening up a new field of immense value scientifically and practically. Whether this early study was followed by others, I do not know.

In 1903, Tarchanoff described his apparatus and experiments with the ergograph, having concluded like Corning that consciousness was not essential and that it was the physiological effects that must be measured. He found wide variation in response, according to the kind of music employed, *i. e.*, whether the music be lively or dull, bright or sombre. "It exercises a genuine and considerable influence over the functions of the body. It is a good antidote to the pernicious habit of introspection and self analysis."

I need not give you further citations of the recognition of the value of music as a therapeutic aid by physicians of the past century.

#### EXPERIMENTAL MEASUREMENT OF THE EFFECT OF MUSIC.

Several attempts at experimental measurement of the effect of music have been made. As typical illustrations let me mention that of Mentz, who measured the effect of certain kinds of music upon pulse rate, that of Binet and Courtier who measured its effects upon heart beat and respiration, of Lombard on knee jerk; Tarchanoff on the dynamogenetic effects and that of Weld in terms of introspection. The problem still remains to determine more specifically the basic principles governing the particular type of rhythm, melody, and harmony, and its organic reaction. Such definite information is essential to the intelligent use of music in practical situations of which the administration of anesthesia is one.

In addition to the organic effects, there are two others, the sensory and the imaginative. By sensory, I mean the effect of the sound in and of itself on the sense organ—the pleasure (or displeasure) derived from the progression of the melody and the harmonic arrangement, just as the inspection of a beautiful shade of blue may give pleasure purely on the basis of the beauty of the color.

By imaginative, I mean the many associations which are aroused upon listening to the music. Experiment shows that slow melodic music, particularly that played by stringed instruments, especially quartets, is the most suitable for this purpose.

#### VARIATIONS IN PREFERENCE.

Our work shows also that there is a high degree of consistency in the type of selection which an individual prefers from day to day, but the type of selection most enjoyed in the morning is different from the type of selection most enjoyed in the evening. The explanation is probably physiological, perhaps due to fatigue and thus a change in organic response in the evening as compared with the morning.

A study of music appropriate to given conditions showed a consistency of preference for a certain type of music when tired, another type when irritated, another when excited, others when happy; when eating, or when working. This phase of the problem is particularly pertinent to the selection of the right kind of music for recuperating patients and patients under preliminary observation. One further point which I want to mention is the selection of music for the purpose of changing the mood and attitude of the patients. There is some variability as to the individual's attitude on the question as to whether one prefers music in keeping with the existing mood or one in contrast. In other words, does one when sad, prefer sombre music or gay; when one is tired does he prefer a quieting melody or one that physically stimulates him?

#### JUDICIOUS SELECTION.

If the highest usefulness is to be obtained from the use of music, it is important that the music be in keeping with the mood and attitude *to be desired*, not by the patient but by the physician in charge, and this involves a most judicious selection. One other feature enters here, namely the fact that if the selection be too different, making too great a change it arouses an antagonistic reaction on the part of the listener. It jars and irritates too much. It is necessary that the change be gradual, and the selections contain certain elements of the nature of the existing mood plus certain elements of the desired mood, that shall serve as stimulation to the



change. The objection is raised by some, that it is unfair to the patients to thus make them the subjects of experimentation. Certain doctors in charge of hospital and private cases where music has been tried with the recuperating patients assure one of beneficial results.

#### MUSIC IN RELATION TO ANESTHESIA.

Although there are four definitely defined stages of ether anesthesia—the first in which the patient experiences analgesia, but does not lose consciousness; the second in which there is excitement; the third or surgical stage, and fourth that marked by cessation of respiration and ending with cardiac paralysis and death—the situation is not wholly unlike that of normal sleep. H. A. Bruce defines sleep as the “absence of sufficient external stimuli to keep us awake.” This need by no means be interpreted as total absence of stimuli. If the attention of the individual be sufficiently centered on one stimulus or group of stimuli, it may keep out all others. It is a neurological fact that two stimuli passing centrally at the same time tend to neutralize each other, the stronger more persistent one coming into consciousness.

According to Meyer's principle of induction (and a similar theory is advanced by Sherrington) the nervous process already stimulated along one pathway, tends to draw into its channel the processes established in adjoining neural pathways, thus increasing the intensity of the original excitation. Accordingly if we succeed in getting pleasant stimulation started first, it is more apt to dominate and later stimulation loses its own appropriate meaning in the flow of the original neural process.

In the vast amount of literature on dreams, pleasantness and unpleasantness seem to be quite separated, both as to cause and interpretation. A stimulus which in waking life is pleasant seldom produces nightmare, neither does a disagreeable stimulus produce dreams that delight the owner and lead him into Elysian fields. It certainly seems logical therefore to make the last waking stimuli as pleasant and as quieting as possible. Music causes one to forget grief, frets and worries; it takes one's mind off the fear and dread of what is to come.

Sleep from drugs differs from natural sleep in some respects but many of the same principles apply. Marie de Manacéine recommends the use of a metronome, a softly ticking clock or watch—anything that produces a monotonous sound. It is not merely the monotonous feature that is of value in the use of subdued music, but also the fact that it

arouses the listener's memory and imagination to circumstances outside the immediate situation and stimuli. It reduces the resistance on the part of the patient, and may thus shorten the second stage of ether administration. In addition the *far away* effect of the music may enhance the pleasure which many, who have come through operations, speak of as the delightful experience of riding gradually out into space.

The importance of making the time preceding an operation as interesting as possible cannot be exaggerated. “No food, no excitement, and early to bed,” are the frequent orders. Perhaps music can in some measure supply the deficiency. Certainly no further demonstration is needed of the fact that music has the power of arousing courage. Think back but for a moment on the countless instances during the war, when music roused the soldiers to deeds of admiration and success. Think of the rôle which music played in keeping-up the morale of the men in camp and in active service.

Some of you may already be familiar with the illustration which I wish to cite of the practical application of music by one of our own Pennsylvania surgeons.

Dr. Burdick, of Kane, Pa., reports the use to which he and his associates put a phonograph both in the wards and in the operating room. In the wards it was found to provide a most satisfactory diversion for the sick. Those who were able to be about thus provided the diversion for the less fortunate patients. No interference with sleep was observed; on the contrary his report agrees with those which I have earlier cited. He asserts that fully 95 per cent. of the patients expressed a desire to hear the phonograph and of the remaining only 2 per cent. objected. Dr. Burdick (now deceased) and Dr. Kane then conceived the idea of using music as a diversion during local anesthesia. During the time when the patient was under observation preceding an operation, an attempt is made to ascertain something of the patient's preferences. Then during the operation at some little distance and in a muffled tone the music is played. The results proved satisfactory.

Then due to an incident at the time of an operation in which the patient was put under gas, it was decided to use the instrument in cases of general anesthesia. The instrument in an adjoining room and in muffled tones was used with the result that the anesthesia was usually taken more calmly and with less resistance. Introspection on the part of the patient confirms the opinion that the use of music is a decided help.



## CONCLUSIONS.

An understanding of the various types of music, individual differences and preferences, variations according to time of day, the organic effect of too stimulating rhythms and accents, differences in associations among children and adults—these are but a few of the contributing circumstances which must be carefully studied out by those who would successfully use this procedure.

Amazing achievements have been accomplished by those studying and practicing the art of anesthesia and indeed by some of this very distinguished gathering whom it is my honor to address. However, there are many possibilities of improvement, both in technique and in methodology. There are many details, many contributing circumstances which need experimentation and closer study. Of these, the practical use of music is one. Certain instances showed marked advantage from its judicious use, but we need more specific data concerning its physiological and psychological effects. "To give an anesthetic is one thing, to practise the art of anesthesia is another."

SCHENLEY PARK.

## ANESTHESIA IN RELATION TO MEDICAL SCHOOLS AND HOSPITALS.\*

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CHICAGO, ILL.

That instruction in the art and practice of anesthesia is altogether absent from the curriculum of the majority of medical schools, or totally or inadequately dealt with, was evidenced by the answers to a questionnaire which was sent to all the A and B colleges in the United States and Canada.

Nothing can improve the status of anesthesia, or bring about the proper recognition of anesthetics as a specialty, as the education of physicians and surgeons generally in this branch of medicine, and the proper place to begin instruction is in the medical schools when, true to the Arabian proverb "A man knows not and knows that he knows not." Although after the completion of his internship the physician may never administer an anesthetic, if he has been well-trained, he will know when it has been properly selected and administered; furthermore, he most certainly will be better able to choose

an anesthetist, thereby, safeguarding his patients, than if he were ignorant of the subject.

## THE VALUE OF EXPERT INSTRUCTION VS. LEARNING.

It may be assumed that during the lectures on surgery in every medical college attention is called to anesthetics, which in many instances is little more than a comparison of the relative toxicity of chloroform, ether and nitrous oxid and whether local or general anesthesia is to be preferred in certain classes of patients. This can not be called systematic instruction. The result is that the majority of physicians obtain their knowledge from experience, at the expense of innocent patients, after graduation when they have gone beyond expert instruction and supervision.

The information which a man obtains through systematic instruction in college and supervision during an internship, is of far greater value than what he obtains from the experience of many hundred administrations without previous instruction. If anesthesia were systematically taught the standard of the average skill in administration would be raised as well as the general knowledge of the subject and the direction in which desirable improvements might be made, foreseen.

Undoubtedly a very large proportion of anesthetic deaths can be ascribed to faulty administration rather than to any specific action of the drug administered. It therefore becomes our duty as physicians and anesthetists to minimize if we can not entirely avoid fatal results, and this can only be accomplished by painstaking instruction and supervision of the inexperienced.

## THE METHOD OF TEACHING ANESTHESIA IN RUSH MEDICAL COLLEGE AND THE PRESBYTERIAN HOSPITAL.

The incentive in outlining the method of teaching anesthetics, which has been developed in Rush Medical College and the Presbyterian Hospital, Chicago, was brought about by the numerous letters of inquiry which the author has received relative to the plan pursued.

During the first two years of medicine in the courses in chemistry, physiology and pharmacology the student studies the physical properties and physiological action of the various anesthetic agents, and upon this foundation the clinical instruction is built. When he enters his senior year he has had physical diagnosis and therefore is able to recognize diseases of the lungs and heart, likewise, he is familiar with urine and blood tests and their significance, and is now ready for the regular course in anesthetics. The didactic instruction is given during the Fall and Spring quarters and is one of the re-

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quired courses for graduation. The practical work consists of demonstrations and administrations under the direct supervision of a specialist and is given throughout the school year. The didactic instruction consists of a systematic review of the entire subject of anesthetics. A brief outline of the didactic instruction which fairly covers the field is as follows:

(1) History of Anesthesia—ancient and modern.

(2) Anesthetic Agents local and general; physical properties and physiological action of chloroform, ether, nitrous oxid-oxygen, ethyl chlorid and ethyl bromide.

(3) Acidosis or secondary chloroform poisoning.

(4) Inflammability of ether and methods for the control of the same.

(5) Decomposition of chloroform and its effects.

(6) Different Methods, local and general, for producing anesthesia with a detailed description of each. Exhibition of apparatus for gas-oxygen, intrapharyngeal and intratracheal insufflation.

(7) Preparation of the patient for local and general anesthesia and the after-care are thoroughly discussed. Positions of patients for various operative procedures.

(8) Selection of the Anesthetic, local and general, and method best suited for its administration.

(9) Alkaloidal Administration before Anesthesia. Drugs employed, advantages and disadvantages.

(10) Difficulties and Accidents during and following anesthesia, their cause, prevention and control. Different methods of resuscitation.

(11) Effects of anesthetic agents on the nervous system, special reference to respiration and circulation and the effect of hemorrhage, asphyxia and bodily posture during anesthesia.

(12) Reflexes, their character and significance.

(13) Kidney function and blood changes during and following anesthesia.

(14) Pathological lung, heart, kidney and blood conditions which may complicate anesthesia.

(15) Blood Pressure, its significance and bearing on the selection of the anesthetic, and use as a guide during anesthesia.

(16) Lung complications following anesthesia.

(17) Legal aspect of anesthesia.

Unless a request comes from the class shock is not discussed.

The technic of local anesthesia is given in the courses of operative surgery and in clinical surgery.

#### TRAINING OF INTERNES.

Only students who are graduates of Rush Medical College are admitted as internes in the Presbyterian hospital, consequently they have had the regular college courses in anesthetics. When they begin their anesthetic service their administrations are supervised but as they become proficient they are given charge of the cases. An occasional visit by the anesthetist in charge keeps them in line and prevents slips in their technic. It is an exceedingly rare thing to find an interne who is not interested in this phase of his hospital work, in fact there is frequently considerable rivalry, in the desire to be considered the best anesthetist among the internes. An interne's reputation as an anesthetist is usually known before he completes his anesthetic service and it is not an infrequent occurrence to have a surgeon ask for a certain man to administer an anesthetic when the attending anesthetists are engaged. To be told by a surgeon or a supervising anesthetist that their "technic is first class and their anesthetics beautiful" is sufficient to make them happy and to stimulate them to greater effort to become proficient, while on the other hand adverse criticism makes them ask for more supervision.

It is perhaps needless to add that the supervising anesthetist must be a member of the hospital staff in order to maintain proper discipline among the internes, furthermore, he must be a physician or quite naturally his knowledge will be questioned and his instruction resented. It is a misfortune as well as an injustice to internes to have a lay person in charge of the anesthetics. Medical graduates rightly feel that it is a retrogression to be taught medicine by a non-medical person and I know of no exception to the statement that under such conditions a man knows as much about anesthetics and anesthesia when he enters the hospital as an interne as he does when he finishes his internship.

110 S. ASHLAND BLVD.

A WESTERN ASSOCIATION OF ANESTHETISTS, INCLUDING SPECIALISTS IN STATES FROM THE MISSISSIPPI TO THE ROCKIES AND FROM CANADA TO THE GULF, WILL BE ORGANIZED AT A JOINT MEETING OF THE MISSOURI VALLEY AND SOUTHWESTERN MEDICAL ASSOCIATIONS AND THE MEDICAL MEN OF THE WORLD'S WAR, IN KANSAS CITY LATE IN THE FALL. THOSE WHO ARE INTERESTED IN JOINING SHOULD GET IN TOUCH WITH THE EDITOR OR DR. MORRIS H. CLARK, 800 RIALTO BLDG., KANSAS CITY, MO.



ON THE RATE OF EVAPORATION OF  
ETHYL CHLORID FROM OILS.\*CHARLES BASKERVILLE, PH.D.  
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NEW YORK CITY.

The determination of the rate of evaporation of ether from various oils<sup>1</sup> gave the foundation of ether-oil colonic, and later oral anesthesia introduced by Gwathmey<sup>2</sup> and since extensively used by discriminating surgeons and specialists with gratifying success<sup>3</sup>. In particular cases analgesia is preferred to anesthesia, in so far as the one may be caused to prevail. Analgesia is evident previous to anesthesia during induction and obtains as the patient comes out of the stage of full anesthesia, the period of analgesia varying in time and degree with the drug administered, rate of administration, body saturation, and rate of elimination. Analgesia is desirable in minor short, as well as prolonged, operations in dentistry, when recourse need not be had to anesthesia. Analgesia, without anesthesia, offers opportunity for comfortable dressing of serious wounds, which causes great suffering on the part of the operated patient. Prolongation of postanesthetic analgesia reduces the necessary time of anesthesia for the sewing of the incision; and the dressing may be done during that period.

Cocain, stovain, novocain, and this general class of drugs are most useful for such purposes, being applied in various ways, but their use is always attended unhappily with an element of uncertain idiosyncrasy, often with serious consequences.

## UTILITY OF ETHYL CHLORID FOR ANALGESIA.

Ethyl chlorid in quantity is about six times as strong, this term being used for lack of a better, as ethyl ether, and when judiciously administered produces prolonged pre- and postanesthetic analgesia. Furthermore, its physiological action is less accompanied with the variegated hallucinations always evident in patients to whom nitrous oxid is administered. At the suggestion of Dr. J. T. Gwathmey, the senior author's medical colleague in all his researches on anesthesia<sup>4</sup>, formal investigation was undertaken on the rate of evaporation of ethyl chlorid from oils and mixtures of ethyl chlorid and ether from oils with the view of using the results as a basis for inducing analgesia, or prolonging it in

conjunction with anesthesia, for the purposes indicated above.

## THE RATE OF EVAPORATION OF ETHYL CHLORID MIXTURES.

The mutual solubility of ethyl chlorid and oils presented nothing novel, but the physical properties of the former (b. p. +12.5°C.) indicated likely marked variations in rates of evaporation from ethyl ether (b. p. 34.6°C.) On account of the extremely rapid evaporation of ethyl chlorid at ordinary room temperatures, all mixtures were pre-

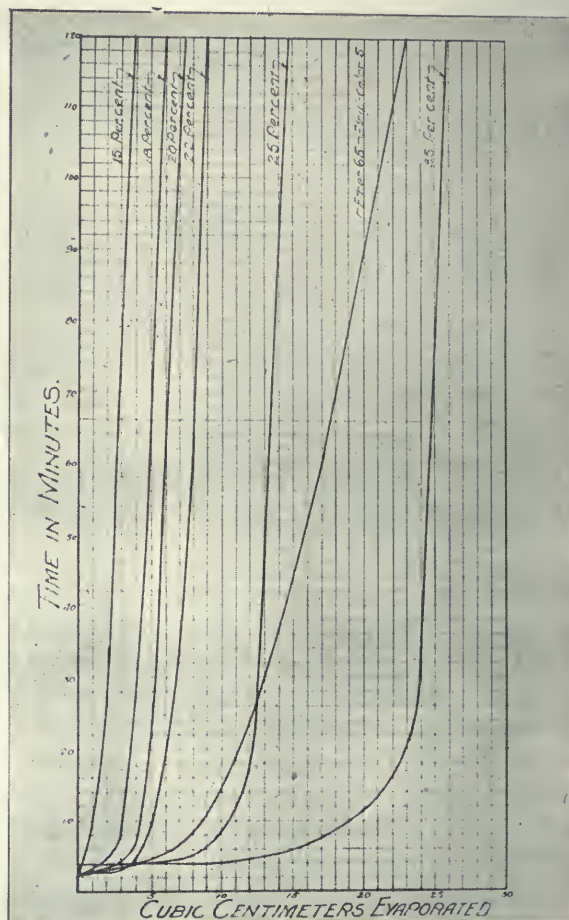


Fig. 1. Chart illustrating evaporation of Ethyl Chlorid-oil mixtures.

pared cold after containers and constituents had been chilled by melting ice.

The rate of evaporation of ethyl ether from different oils<sup>5</sup> having been shown to be practically the same, or parallel, only one oil was used in these experiments, *viz.*, neutral corn oil, which had been refined by the process of the senior author<sup>6</sup>. The ethyl chlorid used was "Kelene" and the ether was ninety-seven per cent. ethyl ether and three per cent. ethanol, purified by the senior author's process.<sup>7</sup>

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society, William Penn Hotel, Pittsburgh, October 5-7, 1920. Also presented at the Chicago Meeting of the American Chemical Society, September, 1920. †DuPont Scholar, College of the City of New York.



## EXPERIMENTAL METHOD AND RESULTS.

The procedure was essentially that described in a previous paper.<sup>8</sup> However, the rate of evaporation of ether from oil having been shown to have a direct ratio to the surface exposed and related to the distance from the surface of the liquids to the top of the vessels, tubes of uniform size were used.

It is recognized of course that results obtained by such experiments do not disclose the conduct of such mixtures when in contact with the walls of the alimentary canal. The glass water thermostat was stirred by air and kept at a constant temperature by heating coils of resistance wire. The temperature of the bath was kept at 37°C. (+0.1C), a calibrated thermometer, reading to hundredths being used. All mixtures were prepared as noted above, at the temperature of melting ice. Large glass tubes, all of the same diameter and walls of practically the same thickness, calibrated to 1 cc. from 20 cc. to 105 cc., were weighted with lead to maintain their position in the ice bath and later when suspended in the thermostat, readings were taken every minute to determine the maximum volume expansion up to 37°C. After that, readings were made every five minutes for two or three hours.

The following mixtures by volume, measured at the temperature of melting ice, were used:

<i>Oil</i>	<i>Ethyl chlorid</i>
65	35
75	25
78	22
80	20
82	18
85	15

The chart (Fig. 1) gives a graphic representation of the results obtained. The abscissae show the number of cubic centimeters of ethyl chlorid evaporated from the oil and the ordinates the time of evaporation. The experiments offering results of value in connection with our particular object were verified by frequent repetition.

The mixtures containing 25 per cent. or more ethyl chlorid by volume boiled vigorously during the time the temperature rose to 37°C. The use of

such mixtures for internal administration was obviously out of question. However, it was determined that the rate of evaporation of ethyl chlorid from oil quickly acquires a definite and fairly fixed speed, which begins when the solution has acquired a volume composition of 13 to 14 per cent. of ethyl chlorid. If an original mixture of 15 per cent. be used, the uniform speed is established within ten minutes for surfaces exposure obtaining in the experiments.

## PRACTICAL APPLICATION.

These facts may later prove to be of moment in ethyl chlorid-oil alimentary administration, for as animadverted, 5 cc. of ethyl chlorid are equivalent to 30 cc. of ether as an inhalation anesthetic, although animal experimentation carried out by Drs. James Taylor Gwathmey and George Barclay Wallace in the Bellevue Laboratories, New York, with ethyl chlorid-oil colonic administration, have not so far been encouraging; yet most satisfactory results have been obtained by Dr. M. Ecker in co-operation with Dr. Gwathmey, in dental surgery. The technique is very simple. A vessel containing an eighteen per cent. ethyl chlorid mixture is interposed in the train of the nitrous oxid-oxygen mixture on its way to the patient. Just enough ethyl chlorid vapor is picked up by passing over about 5 cm. of the ethyl chlorid mixture to induce analgesia for the extraction of teeth without the patient having experienced the excitement stage just prior to surgical anesthesia, so noticeable in the use of nitrous oxid. And only a few hundred cases of humans have been so treated up to date, even though with the most gratifying success, it is too soon to draw conclusions.

## KEEPING QUALITIES OF MIXTURE.

However, sufficient data were accumulated to warrant a study of the keeping qualities of such mixtures as might prove to be most useful in dental surgery. The insertion of anesthol (ether, 47.1; ethyl chlorid 17; chloroform, 35.89 per cent.) in the train has proven most successful in about 4,000 cases.

Four ounce mixtures (actually 135 cc.) of 18, 20 and 22 per cent. (by volume) of ethyl chlorid

	18 Per Cent.	Loss	20 Per Cent.	Loss	22 Per Cent.	Loss
Wt. at 6:00 p. m. . . . .	223.5 g		220.5		221.3 g	2.1 g
Wt. at 11:00 a. m. next day..	221.0	2.5	216.5	4.0 g	219.2	2.1
Wt. at 1:50 p. m. . . . .	220.7	2.8	216.0	4.5	218.7	2.6
Wt. at 4:45 p. m. . . . .	220.2	3.2	215.5	5.0	218.2	3.1
Wt. next day at 5:00 p. m....	218.0	5.5	213.0	7.5	216.5	4.8
Wt. one week later . . . . .	211.5	12.5	207.0	13.5	213.0	8.3
Wt. 12 days later . . . . .	209.5	14.5 g	203.0	17.5	204.5	16.8



and corn oil were placed in loosely stoppered bottles and allowed to stand at room temperatures. At various times the bottles were weighed to ascertain the loss by evaporation. During some of the time intervals the stoppers were removed a few minutes. The accompanying table shows the losses observed:

It is thus to be noted that such ethyl chlorid-oil mixtures must be tightly closed or kept in a refrigerator to prevent change in composition. In fact, it is advisable to make up such solutions immediately before use so that the anesthetist may know the quantity of anesthetic he is administering.

#### ETHYL CHLORID-ETHER-OIL MIXTURES.

As ether-oil (usually 75:25) has proved to be such a valuable adjunct to the comfort of the patient in operations and dressings, by either colonic or oral administration<sup>10</sup> and as ethyl chlorid exhibits such desirable analgesic effects, a mixture of oil, ether, and ethyl chlorid was prepared and the comparative rate of evaporation determined. For reasons already indicated above, the mixture was made up of oil, 30 per cent.; ether, 65 per cent.; and ethyl chlorid, 5 per cent. The curve obtained is plotted on the chart. As yet clinical data are not available for drawing any conclusions.

Further studies of mixtures have been inaugurated in this laboratory with a view of adapting them in special fields of surgery and treatment of the more elusive nervous and mental disturbances.

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THE ASSOCIATED ANESTHETISTS HAVE PRESENTED A FORMAL MEMORANDUM TO THE COUNCIL ON SCIENTIFIC ASSEMBLY FOR A SECTION ON ANESTHESIA IN THE A. M. A. THE SPECIALTY NEEDS THIS RECOGNITION TO COME INTO ITS OWN AND YOU CAN MATERIALLY HELP BY HAVING ONE OF THE PETITIONS FOR SUCH A SECTION SIGNED BY AS MANY INFLUENTIAL FELLOWS OF THE A. M. A. AS POSSIBLE. KINDLY ACT AT ONCE IN THIS MATTER.

## SYNERGISTIC ANESTHESIA FOR DENTAL SURGERY.\*

M. ECKER, D.D.S.,  
NEW YORK CITY.

When anesthetics were first used, the comparison lay between hypnotism, their immediate predecessor, and ether, with the result that hypnotism was quickly relegated to oblivion. With the introduction of ether, nausea and vomiting were accepted as a matter of course. In capital operations the after-effects are of little moment in comparison with the magnitude of the operation. In a dental office, however, the by-effects cannot be overlooked; and as the extraction of a tooth is not a capital operation, the sickness and disgusting after-effects of ether should not be tolerated. It was therefore by a natural evolution that in dental surgery the first refinement in anesthesia should take place. This was the elimination of nausea and vomiting by the use of nitrous oxid instead of ether. For many years this gas used alone, and even today with many dentists the cardinal sign of anesthesia is cyanosis.

#### ASPHYXIAL AND NON-ASPHYXIAL ANESTHESIA.

Cyanosis and asphyxia are almost synonymous terms. In the early days *anesthesia* meant *asphyxiating the patient*, removing the mask, and quickly completing the operation. If the tooth was broken or if the operation was incomplete, the mask was reapplied, the patient again asphyxiated, and the extraction completed. With nitrous oxid, asphyxiation is comparatively safe, for this reason: The antidote is air; when the mask is removed for the extraction, the next breath supplies the patient with air and he quickly returns to normal. Once in so many times respiration does not, immediately return; then the dental chair must be quickly lowered, a slap on the chest given, and artificial respiration commenced immediately. This is usually successful, but deaths have occurred, and to the operator the knowledge of this possibility is ever present.

With the introduction of oxygen the asphyxial factor was eliminated, and by this combination a deeper and a safer anesthesia is secured than with nitrous oxid alone. With certain patients, however—the athletic and the alcoholic—the anesthetic must be pushed, and while the patient's color is partly retained by the oxygen, certain other signs of asphyxia or anoxemia may be present—such as twitching of the muscles and jactitation. Even with this infringement upon the danger zone the anesthesia is not entirely satisfactory.

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society and the Odontological Society of Western Pennsylvania, William Penn Hotel, Pittsburgh, October 5-7, 1920.



## THE EVOLUTION OF PERFECTED DENTAL ANESTHESIA.

Accordingly, with the idea of obtaining a safer, deeper, and more satisfactory anesthesia than heretofore possible, a new and different technic was sought and finally evolved. We can now quickly obtain an even, deep anesthesia in all cases, while at the same time keeping the patient's color pink and normal, and averting all jactitation and anoxemia. Not only is the work more satisfactory from the patient's standpoint, but the dentist emerges from a hard day's work in a quiet, normal condition, secure in the knowledge that not a single patient has been placed in the danger zone. Safety must be the first consideration. The pink color, normal pulse and respiration, and the quiescent state of the muscles all prove beyond question that the danger zone is not approached with the new technic, while the narcotic effects of the nitrous oxid are maintained and the anesthesia can be continued indefinitely.

At one time an attempt was made to minimize nausea and vomiting by employing chloroform instead of ether, but as the toxicity and pathological effects of this drug became apparent the use of ether was resumed and it is today the anesthetic of choice in the vast majority of surgical operations.

Then morphin alone was tried in surgery, but with this method the analgesia and danger zones were found to lie too close together and it was abandoned, though morphin is now almost universally employed as a preliminary and postoperative adjunct to chloroform, ether and nitrous oxid and oxygen. It is also used with local, spinal, and regional anesthesia. Such combinations, mixtures, and sequences of anesthetic agents have proved to be safer and more satisfactory in surgery than any one agent alone.

## NECESSITY OF SYNERGISTS IN DENTAL ANESTHESIA.

For routine dental work, these synergisms are not practicable. While nitrous oxid-oxygen *alone* is applicable for 50 per cent. of dental cases, there remain 50 per cent. in which it is not satisfactory. The brain is not completely blocked from the field of operation. Many operators strap the hands and body of all patients, thus acknowledging the possibility of an irregular and unsatisfactory narcosis at any time.

With gases alone, an uneven narcosis—such as movement during extraction—prevents the dentist from doing his best work, and for this reason they are unsatisfactory—although the patient may remember neither pain nor movement after recovering from the anesthetic. In fairness to the patient, the old technic should be improved.

A hypodermic of morphin is impractical except for hospital cases; nor can we use ether-chloroform and ethyl chlorid as they are generally employed in hospital clinics, but by adapting certain fundamental principles that have been tested and found satisfactory in surgery we have secured a safer, more even and satisfactory anesthesia than any heretofore employed in dentistry. *Safer*, because the patient is *pink* from start to finish and never cyanosed at any time, with pulse and respiration always normal; *even*, because no holding straps are required for any patient; *satisfactory*, because the dental work can be completed without haste.

The method to be described was evolved after using nitrous oxid-oxygen alone in over 55,000 cases. To date, I have used the new method in over 5,000 cases. The abdominal belt and arm straps for the unusual case have been discarded. The nausea and vomiting are about the same as with nitrous oxid alone or combined with oxygen.

The surgical and dental problems are fundamentally the same. The brain block is incomplete and unsatisfactory with nitrous oxid-oxygen *alone*. In surgical practice they are supplemented with morphin-ether and local anesthesia. Our final technic now being followed in all cases was evolved as follows:

Nitrous oxid and oxygen in sufficient quantity to produce unconsciousness was passed over the surface of the agent used, relying upon this addition to complete the brain block. Cotton-process ether was tried first. The anesthesia obtained in this way was perfect, but the after-effects compelled a halt. Then anesthol (composed of 17 per cent. ethyl chlorid, 35.89 per cent. of chloroform and 47.10 per cent. of ether) was tested. This anesthesia was quite as satisfactory as that with ether, and with only six cases of nausea in 62 patients. The return to normal was more rapid than with ether alone.

Paraldehyde was tested in 130 cases. There was very little change in the anesthetic over gas-oxygen *alone*. There was no nausea, vomiting, nor headache, and the posthysterical cases were eliminated.

A mixture of ethyl chlorid in oil was next used, and although as much as two drams of ethyl chlorid per patient was used not enough change in the anesthesia was noted to continue its employment.

A solution of paraldehyde and anesthol, 50 per cent. each, was next tried with results so satisfactory that we have retained this combination as our final technic. Ten drops of anesthol is the average amount used with each patient, and while the



bouquet of the paraldehyde is slightly distinguishable at the patient's face, the amount used in each case is negligible.

#### COMPARISON OF RESULTS.

In a freshly prepared mixture of anesthesol and paraldehyde, if the exposure is the same in each case, the evaporation is greater for the first five cases—about 40 minims of anesthesol each; after this time, only 12 to 15 minims for each case. The exposure is so regulated that each patient gets about 30 minims of anesthesol.

The comparison between the 55,000 straight nitrous oxid-oxygen and the 5,000 synergistically given anesthetics—as made by my associates, assistants, and others that are in position to compare the two methods—is so obviously in favor of the latter that a return to former methods is simply preposterous. Our minds are still open in the matter and if laboratory tests offer later a simpler and better method we will unhesitatingly adopt it; but we will continue the present technic until some safer and better method is presented.

#### SUMMARY.

To summarize: With Synergistic anesthesia—

1. The induction period averages one minute and a half, using nitrous oxid-oxygen *alone* for the first fifteen seconds; after this, anesthesol and paraldehyde until completion of operation. The induction is smooth and holding straps are unnecessary.

2. The oxygen is used from the beginning of anesthesia. The patient is pink from start to finish.

3. A safer and deeper anesthesia is maintained throughout than with the old method and jactitation is almost absent. There is no movement nor flinching during operation.

4. Recovery is smoother, with less hysteria. Patients can walk unassisted from chair to waiting room.

5. The incidence of nausea and vomiting is the same as with nitrous oxid-oxygen, *i. e.*, as far as the patient is concerned he is unaware of getting anything but the gas-oxygen.

6. With the face mask method the operating period averages one to two minutes in comparison with thirty seconds with the gases alone. With the nasal inhaler, it can, of course, be continued indefinitely.

7. Finally, as a sequence to the increased safety, ease, and comfort of operating upon an unflinching patient, the physical and nervous strain upon the operator under the old system is entirely removed, and this conservation of energy is a factor that should not be ignored.

147 FOURTH AVENUE.

## STANDARDIZATION OF NITROUS OXID-OXYGEN ANESTHESIA INDUCTION.\*

J. A. HEIDBRINK, D.D.S.,

MINNEAPOLIS, MINN.

In early days before oxygen was used in combination, nitrous oxid, because of its fleeting qualities, was limited in its scope of usefulness. There was time only for short and hasty operations. When apparatus first appeared for combining oxygen the anesthesia could be prolonged, providing the anesthetist was sufficiently skillful to anticipate symptoms and make adjustments in the constantly varying mixture, due to the crude proportioning devices then obtainable. However the addition of oxygen was a long step in the right direction.

Some became expert and administered beautiful anesthesia. Some were moderately successful. The majority failed miserably. There being no uniformity of dosage, there could be no uniformity of induction. The result was an exaggerated idea of the variation in susceptibility of individuals to nitrous oxid. These failures created in the minds of many the idea that there was something mysterious about nitrous oxid-oxygen administration, and that to be successful, one must possess the *sixth sense*. Much of this impression still persists and is the *bugaboo* standing in the way of many good and capable men beginning the use of nitrous oxid anesthesia. With present day apparatus, accurate predetermined dosage can be delivered and nitrous oxid-oxygen administration is *very* much simplified.

#### THE NEED FOR CAPABLE ANESTHETISTS.

There is great need of more capable nitrous oxid-oxygen anesthetists, not only in the dental field, but in the field of general surgery, that humanity may benefit by this most valuable anesthetic.

Men of the professions in rapidly increasing numbers are beginning the use of nitrous oxid, many with insufficient preparation. These are dependent upon such as the members of this organization for their training. The burden is upon us. The more we can simplify and standardize technic, the more rapidly we can teach them, and the more will the public be safeguarded. To my knowledge there is little or no opportunity for this ever-increasing number to secure the prolonged training and experience, under supervision, necessary to make of them expert anesthetists. The best we can hope to do is to give them a foundation upon

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society and the Odontological Society of Western Pennsylvania, William Penn Hotel, Pittsburgh, October 5-7, 1920.



which to build, advising them to avoid the more difficult subjects until knowledge has been gained through experience.

#### THE EVOLUTION OF STANDARDIZED INDUCTION.

If it is practicable to simplify and standardize a technic for administering nitrous oxid-oxygen, necessitating the minimum deviation to accommodate exceptional cases or unusual conditions, then a long felt want has been met.

With this idea in mind I conducted experiments, ending March, 1919, in approximately 4,500 cases, to determine the comparative susceptibility of patients. Since that date the findings have been verified by thousands of additional administrations both by myself and others.

A satisfactory dosage for induction having been determined by experimentation, a definite technic for manipulating the apparatus was rigidly adhered to, and the anesthesia induction was timed by a stop watch. Then with all elements standardized, any variation in results was evidently due to variation in the susceptibility of the patient.

In selecting the dosage, the aim was to procure a comfortable induction and a distributed anesthesia in as short a time as practicable. Anesthesia should not be induced too rapidly. For instance, were we to administer pure nitrous oxid from the beginning, without dilution with oxygen or air, it acts so rapidly that the first nerve centers, with which it comes in contact, may become anesthetized before there was time for general distribution of the gas and the patient might show pronounced symptoms before complete anesthesia was actually accomplished. If operated upon the patient might feel pain. Anesthesia so quickly induced is not well established and is difficult to maintain while operating in the mouth.

#### EXPERIMENTAL DATA.

The dosage used in the experiments was nitrous oxid 95 per cent. and oxygen 5 per cent., administered for one minute, followed by pure nitrous oxid until the depth of anesthesia was obtained, usually indicated by the ashen hue of the face and slight twitching of the eyelid, which is the beginning of anoxemia and jactitation. Then oxygen was again added. All anesthetics were for oral operations and were carried to the stated depth to allow latitude for maintaining anesthesia with the mouth open. The dosage is not intended to apply to anesthesia for major surgical operations. For extra-oral operations, where both the mouth and nose may remain covered to exclude all air, a much lighter anesthesia can be easily maintained. Light anesthesia should be more slowly induced to allow time for better distribution of the gases.

Accurate records were kept of the induction of 2,044 consecutive anesthetics. Of this number 1,828 (or approximately 90 per cent.) responded uniformly to the common dose, were classed as *normal* and divided according to age as follows: 1,715 adults were anesthetized in 1 minute and 40 seconds; 43 children, aged 10 to 15 years, were anesthetized in 1 minute and 35 seconds; 70 children, aged 10 years or under, were anesthetized in 1 minute and 30 seconds.

The remaining 10 per cent. of patients required 5 to 20 seconds longer induction and were classed as *abnormal*. By observations made and the histories obtained they were divided into three types as follows: *Athletes* 67 (robust individuals more resistant to anesthetic influence); *stimulated* 113 (habitual users of alcohol or narcotics); *excitable* 19 (the nervous or hysterical type). Seventeen apparently normal individuals varied from the common dosage as follows: 9 were anesthetized in 1 minute and 50 seconds; 3 in 1 minute and 35 seconds; 1 rapid breather was anesthetized in 1 minute and 35 seconds; 1 shallow breather and 1 shell-shocked soldier, who were anesthetized in 1 minute and 50 seconds; and 2 children, aged 10 to 15 years, anesthetized in 1 minute and 30 seconds.

#### NORMAL AND ABNORMAL SUSCEPTIBILITY.

*As previously stated it has been the general opinion that patients vary greatly in susceptibility to gas anesthesia, and that each one is a law unto himself. Abnormal patients, constituting 10 per cent., do vary from normal in susceptibility, some quite markedly; but normal individuals, constituting 90 per cent., are so nearly uniform in susceptibility that they respond quite similarly to a common dose.*

Do not understand me to recommend that the timing of the induction is to displace the observance of symptoms. The abnormalities are to be reckoned with. Any variation in technic may also change the time of induction. A thorough knowledge of symptoms is imperative, and that they must, at all times, be observed and heeded is of paramount importance.

Timing furnishes the cue as to when anesthesia symptoms should appear. From the data given you will notice that in only three adults, or one in 700, was the time of induction less than one minute and forty seconds, and in these three cases the induction period was only five seconds less than normal. Doubtless the induction could have been prolonged five seconds without harmful results. Only one in 10 required longer than normal induction.



## THE STANDARDIZED TECHNIC.

It would seem practical then to instruct the beginner to follow a definite routine technic for manipulating his apparatus during the induction. With uniform dosage administered anesthesia symptoms may be expected, to appear at a definite time. In no case should the induction be carried beyond a certain time limit. It is exceedingly dangerous to attempt to put the extremely stimulated types of patients into *quiet* anesthesia. Using the described dosage the time limit for induction has been set at two minutes.

oxid enters the blood stream it displaces oxygen. Therefore the blood is blue in proportion to the oxygen displaced. Since normal individuals when anesthetized have absorbed practically an equal amount of nitrous oxid, it is reasonable to presume that there is a corresponding uniformity of blueness of the blood. The extent to which this blueness is evident depends upon the complexion of the patient. Individuals with fair, thin skin, rosy cheeks or florid complexion, show the color of the blood more vividly and sometimes display marked cyanosis before completely anesthetized. Because of these premature symptoms the beginner often operates too

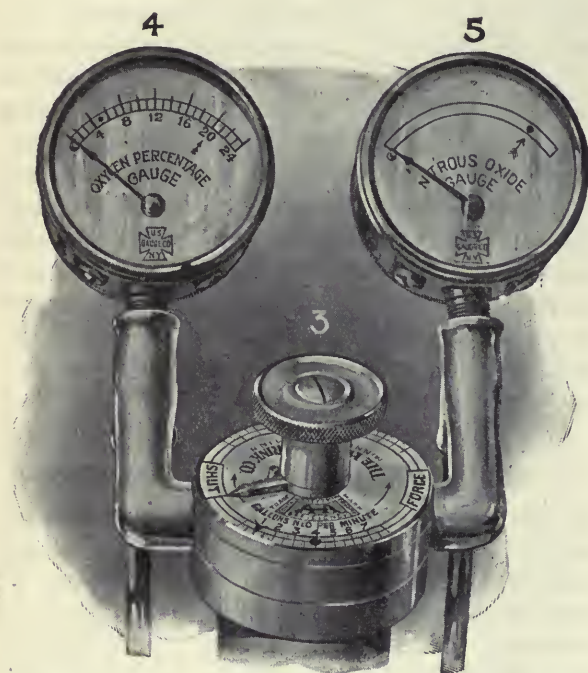


Fig. 1. Showing the author's apparatus with valves controlling pressure from tanks, (1-2), valve regulating flow of mixture (3) and gauges showing percentage of gases (4-5).

When anesthesia is established 5 per cent. of oxygen is added and this mixture is increased in volume to force it through the nose. This amount of oxygen, plus the air usually inhaled through the mouth while operating, is sufficient to carry the majority of patients through an ordinary dental operation without necessitating changes in mixture or volume. When indicated, changes in oxygen percentage are made.

## EVALUATING SYMPTOMS.

The beginner usually finds difficulty in recognizing symptoms of complete anesthesia. Early appearance of any one symptom such as cyanosis, jactitation or stertor, is sometimes misleading. Cyanosis of some degree is a necessary accompaniment to nitrous oxid anesthesia. When nitrous



Fig. 2. Showing stop-watch attached to the apparatus to time the induction period.

soon and the patient suffers pain or develops excitement or both. The common error of beginners is to operate in an anesthesia too light to be maintained or to control the patient.

Timing assists in judging the maturity of symptoms.

Since conducting these experiments I have practiced and taught this method with good results. The beginner is furnished with a routine technic which he readily acquires.

The *experienced* anesthetist may have his own ideas as to what constitutes a desirable dosage or resulting anesthesia. But whatever his belief as to proportion of gases in the mixture, time for induction or depth of anesthesia, he will obtain more uniform results by following a standardized technic for the induction.

616 DONALDSON BLDG.



# American Journal of Surgery

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APRIL

EDITORIALS

1921

### WHO BENEFITS BY THE SAFETY FACTOR OF THE EXPERT MEDICAL AND DENTAL ANESTHETIST?

The general Practitioner and the Occasional Surgeon not only have an especial interest in the recovery of their patients, but also a very vital interest in maintaining their prestige in their own communities and among their personal clientele. Deaths, during or shortly following operations under anesthesia, usually create a great deal of unfavorable comment against all concerned in the operative procedure, especially if sufficient care has not been taken to determine the real surgical risk of the patient and to provide the safety factor of expert professional anesthesia.

The physician, who sends a patient to one of his surgeon associates for an operation, without warning the family of any imminent risk, is placed in a very awkward position if he has to explain, as the outcome of his advice, an unwarranted anesthetic fatality.

The General Practitioner has two courses of conduct open to himself. If he wishes to protect his patient personally by giving the anesthetic he should by all means perfect himself in the best routine methods of administration as well as in the details of preliminary preparation and postoperative care. If he does not care to assume this responsibility he will do well to see to it that whoever he refers his

surgical cases to employ only the most reliable professional anesthetists. The General Practitioner should not expect the surgeon to supervise the anesthesia at the same time that he operates. No surgeon can do two jobs well at the same time, and to operate and supervise the anesthesia, the surgeon must neglect one or the other of these important duties.

In these days of intensive instruction in all phases of practice there is no longer any excuse for the General Practitioner to be a tyro in the proper administration of anesthesia. If he so wishes he can readily become proficient enough to handle safely and effectively all routine methods, not only in operating room surgery, but also in the specialties, industrial clinics and in obstetrics. The fact of the matter is that thousands of General Practitioners should be using general and local anesthesia in their daily practice. In not doing so they are neglecting a very profitable phase of their work.

If the General Practitioner does not care to meddle with anesthesia then he will find it most profitable to use the services of some professional associates, medical or dental, who have perfected themselves in the use of anesthetics. In so doing he should explain to his patients the extra care he is taking in rendering his treatment painless and safe and those of his clientele, who know anything, will be only too glad to pay for the additional service. In fact a number of anesthetists in the larger cities are establishing Anesthesia Clinics to which General Practitioners, Occasional Surgeons and Dentists are taking their patients and performing the operations while the expert anesthetist gives a protecting anesthesia.

It is a blot on the escutcheon of medicine that there are still so many uncalled for anesthetic fatalities. The idea that the lay-anesthetist has added anything of safety to anesthesia is fallacious in the extreme, as any impartial survey of the situation will reveal, and surgeons who still try to operate and supervise their anesthetics are simply trifling with the sanctity of human life.—McM.

### THE ELECTION OF MORTON—ANESTHETIST—TO THE HALL OF FAME

The outcome of the recent election of W. T. G. Morton, to the Hall of Fame, must be gratifying to every American physician and dentist who is familiar with Morton's life, his struggles for recognition and the sad experience he was made to undergo by those who wished to withhold the credit for his work.

In the election Morton was tied with our beloved Mark Twain with 72 votes. It is certainly a



remarkable thing that the electors should have selected the member of the profession who stood in the public eye for the discovery of anesthesia. This would seem to indicate that the public has a deeper feeling about the importance of anesthesia than is commonly supposed.

It is indeed unfortunate that at this remote time Morton's election should be used by some to revive the bitter controversy about the discovery of anesthesia. It has been rather definitely determined, historically, that many members of the profession figured conspicuously in the evolution of anesthesia and that no one of them can claim entire credit. The names of Davy, Long, Wells, Jackson, Bigelow, and Holmes are all intimately associated with the development period of surgical and dental anesthesia and no one can now detract anything from their individual contributions. All that remains is to see that each of them is as conspicuously honored as Morton has been.

Our great physician poet, the late Weir Mitchell, has immortalized the tragic life of Morton in the following touching lines:

What angel bore the Christ-like gift inspired!  
What love divine with noblest courage fired  
One eager soul that paid in bitter tears  
For the glad helping of unnumbered fears,  
From the strange record of creation tore  
The sentence sad, each sorrowing mother bore,  
Struck from the roll of pangs one awful sum,  
Made pain a dream, and suffering gently dumb!  
Whatever triumph still shall hold the mind,  
Whatever gift shall yet enrich mankind.  
Ah! here, no hour shall strike through all the years,  
No hour as sweet, as when hope, doubt and fears,  
'Mid deepened stillness, watched one eager brain,  
With God-like will, decree the Death of Pain.  
How did we thank him? Ah! no joy-bells rang,  
No peans greeted, and no poet sang,  
No cannon thundered, from the guarded strand,  
This mighty victory to a grateful land!  
We took the gift, so humbly, simply given,  
And coldly selfish—left our debt to Heaven.  
How shall we thank him? Hush! a gladder hour  
Has struck for him, a wiser, juster power  
Shall know full well how fitly to reward  
The generous soul that found the world so hard.  
Oh! fruitful Mother—you, whose thronging states,  
Shall deal not vainly with man's changing fates,  
Of freeborn thought, or war's heroic deeds,  
Much have your proud hands given, but naught exceeds  
This Heaven-sent answer to the cry of prayer,  
This priceless gift which all mankind may share.

#### THE SEVERAL MEETINGS OF ANESTHETISTS DURING 1921.

The Interstate Association of Anesthetists will hold its Seventh Annual Meeting at the Clifton House, Niagara Falls, June 1-3, in conjunction with the Canadian Society of Anesthetists and the Ontario Medical Association.

The American Association of Anesthetists will hold its Ninth Annual Meeting at the Hotel Bellevue,

Boston, June 6-8, the first three days of A. M. A. Week.

The New York Society of Anesthetists will meet with the New York State Medical Association in Brooklyn, May, 1921.

An Organization Meeting of the Western Association of Anesthetists will be held in Kansas City, Mo., late in October in conjunction with the joint Meeting of the Missouri Valley and Southwestern Medical Associations and the Medical Men of the World's War.

It is also hoped that a Pacific Coast Association of Anesthetists will be organized during the Spring Meeting of the California State Medical Society.

#### IN MEMORIAM

SAMUEL JAMES MELTZER, M.D.

Members of the American Association of Anesthetists deeply deplore the untimely death of Dr. S. J. Meltzer, November 7, at the age of 69, from pulmonary edema following an attack of angina pectoris.

Dr. Meltzer was born in Courland, Russia, March 22, 1851, received his preliminary education at Koenigsberg, Prussia, and his college and medical education at the University of Berlin from which he graduated in 1882. He studied physiology under Prof. Hugo Kronecker, with whom he made early important studies on the deglutition reflex. He came to the United States in 1883, and engaged in the practice of medicine in New York, serving for many years as attending physician to the Harlem Hospital. Dr. Meltzer was a productive contributor to the literature of biology, physiology and experimental medicine. He made numerous studies on the physiology of digestion, respiration and the peripheral circulation, on the pharmacology of magnesium salts, on the vasomotor effects of epinephrin and on the relation of the pancreas to hyperglycemia and glycosuria with reference to diabetes. His investigations on the action of the magnesium salts led to the introduction of magnesium sulphate for the treatment of tetanus and its use in experimental and clinical anesthesia. In 1909 he introduced the method of intratracheal insufflation for the maintenance of artificial respiration and for the administration of anesthetics. The latter procedure made possible much of the detailed work on experimental thoracic surgery for which he was noted in his last years. In 1906 Dr. Meltzer was appointed head of the department of physiology and pharmacology of the Rockefeller Institute for Medical Research, and he retained this position until his death. He was active in many medical and scientific organizations, and founded the Society for Experimental Medicine and Biology, the American Association of Thoracic Surgery, and during the war, the Medical Brotherhood for the Furtherance of International Morality. He was sometime president of the Association of American Physicians. American Physiologic Society, Association for the Advancement of Clinical Research and Harvey Society; a member of the National Academy of Sciences, American Association of Anesthetists; Association of American Pathologists and American Society of Naturalists, and other societies. In 1917, he represented the Section of the Practice of Medicine in the House of Delegates of the American Medical Association. Dr. Meltzer was commissioned major in the Medical Reserve Corps, U. S. Army, in 1917. As an enthusiastic research scholar his name was familiar to medical scientists throughout the world. He possessed an idealism peculiarly fitting him for intensive laboratory studies though perhaps not easily coinciding with the practical side of public life. His associates in scientific life regret the passing of a high minded fellow worker.



## Society Proceedings

*Membership is a society devoted to your specialty is an essential to success.*

### INTERSTATE ASSOCIATION OF ANESTHETISTS —SEVENTH ANNUAL MEETING—JOINT MEETING WITH THE CANADIAN SOCIETY OF ANESTHETISTS AND THE ONTARIO MEDICAL ASSOCIATION, CLIFTON HOUSE, NIAGARA FALLS, JUNE 1-3, 1921.

The Interstate Association of Anesthetists will hold its Seventh Annual Meeting at the Clifton House, Niagara Falls, June 1-2, in conjunction with the Canadian Society of Anesthetists and the Ontario Medical Association.

The following papers and speakers have been tentatively listed for the program:

The Value of Expert Professional Anesthesia to all Concerned, (President's Address I. S. A. A. and Canadian Anesthetists), Samuel Johnston, Toronto, Canada.

Anesthesia—Its Place in the Practice of Medicine, (President's Address N. Y. Society of Anesthetists), John J. Buettner, Syracuse.

Circulatory Depression in Relation to Operation and Anesthesia from a Study of Records, E. I. McKesson, Toledo, Ohio.

Studies in Blood Pressure Reactions under Ether-Oil Anesthesia, G. M. Geldert, Ottawa, Canada.

Clinical Observations on the Effects of Operations and Anesthesia on Blood Pressure, C. J. Wells, Syracuse, N. Y.

Clinical Observations on the Effects of Ether Vapor Tensions, E. A. Tyler, Philadelphia.

Deaths in Relation to Operations for Fibroid Tumors, T. D. Buchanan, New York City.

Myocardial Degeneration in Relation to Anesthesia, Reed O. Brigham, Ann Arbor, Mich.

Further Studies in Blood Changes under Nitrous Oxid-Oxygen Anesthesia, Theodore D. Casto, Philadelphia.

Further Studies in Oxygen Need during Anesthesia, W. I. Jones, and Clayton McPeck, Columbus, O.

Tissue Acidosis vs. Blood Acidosis, W. H. Mercur, Pittsburgh.

Acidosis in Relation to Operation and Anesthesia, Edith M. Ross, Winnipeg, Canada.

The Therapeutics of Decreasing Body Alkalinity, W. H. Porter, New York City.

The Therapeutic Use of Oxygen in Relation to Anoxemia, R. D. Rudolph and Tom Hanley, Toronto, Canada.

Rebreathing in Prolonged Nitrous Oxid-Oxygen Anesthesia, George W. Tong, Brooklyn, N. Y.

Determining the Safe Operative Period for Brain and Skull Surgery, William Sharpe, New York City.

Lessons from Accidents and Near Fatalities in Anesthesia, R. M. Waters, Sioux City, Iowa.

Charting the Signs and Symptoms of Anesthesia for Teaching Purposes, E. A. Peebles, Wilmington, O.

Pressure in Relation to Efficient Anesthesia, Ben Morgan, Chicago.

The Value of Endotracheal Anesthesia in Certain Operative Procedures, Wesley Bourne, Montreal, Canada.

Conserving the Status of Anesthesia as a Specialty, W. B. Howell, Montreal, Canada.

One of the interesting features of the Scientific Program will be a Session devoted to Case Reports of unusual Anesthesia Experiences by leading anesthetists. The final afternoon of the meeting will be devoted to a Joint Session of all the organizations and a program of pertinent papers.

An invitation is being extended the New York Society of Anesthetists to participate in this meeting.

Those who wish to present papers or case reports should get in touch with one of the secretaries at once. Do not fail to bring in all the new members you can.

The Annual Dinner will be served at the Clifton House on the evening of June 2, at 7 o'clock and will be enlivened

with music and afterdinner speakers. The visiting Ladies will be delightfully entertained as usual.

As a large attendance is expected make your hotel reservations at the Clifton House and Associated Hotels as soon as possible.

For further information address

F. H. McMECHAN, M.D., *Secretary*,  
Avon Lake, Ohio, or  
WESLEY BOURNE, M.D., *Secretary*,  
34 St. Mark, St., Montreal Canada.

### AMERICAN ASSOCIATION OF ANESTHETISTS— NINTH ANNUAL MEETING, BOSTON, JUNE 6-8, 1921.

The American Association of Anesthetists will hold its Ninth Annual Meeting at the Hotel Bellevue, Boston, June 6-8, the first three days of A. M. A. Week. An interesting and instructive program of scientific papers is being arranged for this meeting. Among those who have tentatively promised to speak are the following:

Standardizing the Specialty of Anesthesia, (President's Address), Jos. E. Lumbard, New York City.

Methods of Ether Anesthesia, Albert H. Miller, Providence, R. I.

Synergistic Analgesia, James T. Gwathmey, New York City.

Observations of an Anesthetist, Boris Rapoport, Dorchester, Mass.

Nitrous Oxid-Oxygen the Preferable Method of Anesthesia, Harry Harrison, Norfolk, Va.

Acute Dilatation of the Heart during and after Operation and Anesthesia, S. A. Levine, Boston.

Preoperative and Postoperative Treatment of Diabetic Patients, Max Kahn, New York City.

Anurias Occurring in Normal Animals during the Use of Anesthesia, Wm. deB. MacNider, Chapel Hill, N. C.

Acapnia and Anesthesia—A Resume, Yandell Henderson, H. H. Haggard, New Haven, Conn., and R. C. Coburn, New York City.

Studies in Industrial Ether Poisoning, Alice Hamilton, Boston.

Blood Chemistry in Relation to Operation and Anesthesia, Victor Mayer, New York City.

Ether-Oxygen Anesthesia for Cerebral and Spinal Surgery, A. M. Palermo, New York City.

Postoperative Lung Complications, E. C. Cutler, Boston.

Nitrous Oxid in Obstetrics, Paul Appleton, Providence, R. I.

Anesthesia for Dystocia, C. Henry Davis, Milwaukee, Wis. Selective Anesthesia in Obstetrics, Edward P. Davis, Philadelphia.

Local and Combined Anesthesia in Operative Obstetrics, F. C. Irving, Boston.

Alkaloidal Amnesia in Obstetrics, W. Barnes, Indianapolis.

The Boston Society of Anesthetists is in charge of organizing Anesthetic Clinics to be held during the meeting. Those wishing to demonstrate newer methods will kindly get in touch with Dr. Lincoln T. Sise, 31 Powder House Road, Medford, Mass.

The Council on Scientific Assembly has accorded the anesthetists the honor and distinction of granting the Wednesday afternoon Session of the Section on Miscellaneous Topics for a program of anesthesia papers. The Council has appointed Dr. James T. Gwathmey to act as Chairman of this Session, Dr. E. I. McKesson as Vice-Chairman and Dr. F. H. McMechan as Secretary.

Dr. Freeman Allen, Chief of the Department of Anesthesia, Massachusetts General Hospital, expects to arrange to have the old Amphitheater in the dome of the Bulfinch Building, where the first operation under ether was done, opened for inspection and the Morton apparatus will be on exhibition. It is also hoped that Dr. J. Collins Warren, whose grandfather, performed the first operation under ether, will make a few remarks of historical interest regarding the event.

The Annual Dinner will be served at the Hotel Bellevue, on the evening of June 6, and will be enlivened with music



and afterdinner speaking. All those interested should make their plans to attend now and secure their hotel reservations at once.

For further information address

F. H. McMECHAN, M.D., *Secretary*,  
Avon Lake, Ohio.

## Book Review

**Block Anesthesia and Allied Subjects.** WITH SPECIAL CHAPTERS ON THE MAXILLARY SINUS, THE TONSILS AND NEURALGIAS OF THE NERVUS TRIGEMINUS. By ARTHUR E. SMITH, D.D.S., M.D., Oral Surgeon to Frances Willard Hospital and to the House of the Good Shepherd, Chicago. Royal Octavo; 895 pages; 595 illustrations. C. V. Mosby Co., St. Louis, 1920.

The principal object of Smith in writing his book has been to give in a practical and usable form the technic of block anesthesia and to include the important allied medical and surgical phases, which are so closely interwoven and the knowledge of which is so essential to success. The book is primarily for oral surgeons, dentists and students, and an endeavor has been made to cover the subject and the technic step by step in a detailed and thorough manner.

As a special textbook it will appeal to two classes of readers, those who wish to consult it for reference in connection with special cases and those who wish to acquire a systematic knowledge of block anesthesia in all its phases. The technic for the various block injections is based upon anatomy and Smith is to be complimented on the immense amount of personal research he has achieved to place each detail of technic on a scientific and accurate basis, thereby making his advice as simple and practical as possible.

Smith has followed a uniform plan in elaborating the technic of each deep block injection by discussing the typographical anatomy; the needle employed; the technic of injection; the injection of the solution; precautions; the waiting period; the area obtunded; and the blocking of communicating branches. This method enables those using his book to turn to a complete exposition of any desired injection.

Aside from an exhaustive and comprehensive consideration of block anesthesia in relation to dentistry, Smith has devoted special chapters to blocking for tonsillectomy, septal, head, jaw and neck operations and other procedures which are of special interest to oral surgeons and specialists. His technic for injecting the Gasserian ganglion and for blocking in sinus operations will also interest the general surgeon.

After a consideration of the historical evolution of anesthesia and the development of local anesthesia and its methods of application, Smith discusses at length the neuroanatomy of his subject as well as the special anatomy of certain regions. He then elaborates on the fundamentals of block anesthesia itself and considers in detail the various local anesthetics and their combinations and uses. In this matter, as in his anatomical studies, the author has done a great deal of personal research. The armamentarium, preparation of solutions and the general considerations of operative technic are discussed in detail as well as the preparation of the patient, site of injection and field of operation.

After showing the application of block anesthesia to every possible dental, oral and special operation, all illustrated with minute detail and accuracy, Smith concludes his volume with pertinent suggestions regarding the handling of postoperative complications, syncope, shock and collapse.

The volume as a whole is a masterpiece of research and will no doubt endure as a classic on the subject. It is given to few to produce such a work and it is to be hoped that the volume will be as widely read, studied and consulted as it so well deserves.

In this cursory review the Editor feels that he had done scant justice to the volume at hand. It is one of those

books that must be digested to be appreciated. Had Dr. Smith's mother, to whose memory his work is dedicated, lived to see its completion, she would indeed have been immeasurably proud of her son and his work, but no prouder than those who have been associated with him in his career and have learned to know him as a friend.

**Anesthetics: Their Uses and Administration.** By DUDLEY WILMOT BUXTON, M.D., B.S., Member of the Royal College of Physicians; Sometime President of the Society of Anesthetists; Consulting Anesthetist to University College Hospital and to the Royal Dental Hospital of London. *Sixth Edition.* Octavo; 535 pages; 89 illustrations. P. BLAKISTON'S SON & Co., Philadelphia, 1920.

The whole of the Sixth Edition of Buxton has been revised and some sections have been rewritten. The experience gained in the World War has modified and in many ways enlarged our knowledge of anesthetics. This has made it necessary for Buxton to add such material about shock and other anesthetic phases of war surgery as come within the purview of the anesthetist.

Buxton is fully conscious that so wide and complicated a subject as shock cannot be adequately treated in the limitations of a textbook, but he hopes that a brief outline of the theories of shock and more especially of its treatment before, during and after the administration of an anesthetic, may prove of value at least as a guide to research and as an incentive to thought. Germane to this is the new section upon hemorrhage. This includes references to many forms of danger through severe hemorrhage. It is expected that when the anesthetist has his mind stored with such possible sources of danger, he will be better able to understand the problems presented by such cases and so be in a position to apply prophylaxis and treatment.

The chapter dealing with Complications and Dangers has been enlarged and its arrangement modified. It now includes not only the consideration of shock and hemorrhage but also the little understood subject of angio-neurotic edema. A fuller account of massage of the heart is also presented, since that method of resuscitation has proved more successful than it was a few years ago. The Posture of the Patient, important in all cases, whether they are normal or hazardous, has been fully discussed.

Dealing with ether Buxton has recast the whole of his previous work and has added a discussion of the importance and value as well as the method of giving warmed vapors. As the value of such accepted methods as intrapharyngeal and intratracheal insufflation of ether have been fully demonstrated, they are presented in detail with the cooperation of Dr. Shipway.

Buxton believes that for many cases of major surgery the use of nitrous oxid-oxygen administered after alkaloids has been shown to be of great value. Even if its greater safety as compared with ether has yet to be substantiated, in his opinion there is little doubt that, in the hands of not a few anesthetists, the results obtained have established the claim that it is one of the best methods in cases of shock and cognate states.

Buxton has again ventured to repeat his views upon the advisability of avoiding a routine choice of anesthetics. There are many good methods, some valuable in individual cases and dangerous in others. To obtain uniform success the anesthetist must be familiar with all and be capable of fitting the appropriate anesthetic and best method to the exigencies of any particular patient or operation. Otherwise failure or discredit of a method ensues.

The chapters on Local and Spinal Anesthesia have been considerably enlarged. Spinal anesthesia has now become more firmly established as a desirable method in certain cases; its advantages have been proved and its limitations more clearly defined so Buxton retains the invaluable work of Barker and supplies additions and corrections from the further researches and clinical experiences of Rood and others. The kindred subjects of paravertebral, parasacral and sacral anesthesia have also been included in the present edition.

Buxton is to be complimented on the manner in which he



gives the views of all workers as fairly and fully as possible and for his efforts to include descriptions of various new forms of apparatus that facilitate the technic of the anesthetist. This volume is one of the most practical books on anesthesia and it should be in the hands of every anesthetist who wishes to perfect himself in his specialty.

**Oxford Loose-Leaf Surgery.** By VARIOUS AUTHORS. Edited by F. F. BURGHARD, M.S., F.R.C.S., COLONEL A.M.S. and ALLEN B. KANAVEL, M.D., F.A.C.S., COLONEL U.S.A. Volume 1, Supplement. OXFORD UNIVERSITY PRESS, New York, 1920.

This Supplement to the Oxford Loose-Leaf Surgery is of particular interest to anesthetists as it contains several outstanding contributions to the subject of anesthesia. Dr. Isabella C. Herb of Chicago, one of the most noted of women anesthetists, supplies the chapter on General Anesthesia. As Associate Professor of Surgery in Rush Medical College and as Chief Anesthetist to the Presbyterian Hospital, Chicago, Dr. Herb has had an opportunity not only of teaching the subject of anesthesia but of putting her own instruction to the test of clinical experience; consequently her consideration of anesthesia is intensely practical, while at the same time it is based on fundamental pharmacophysio-pathological research.

Beginning with a discussion of the selection of the anesthetic, Dr. Herb reviews the status of chloroform, ether, ethyl chlorid and various anesthetic mixtures. Continuing she details the proper use of preliminary medication and preparation of the patient. She explains in detail the various routine and special methods of general anesthesia and then takes up the problems of complicating factors and after-care. Her advice throughout is in consonance with the best practices of the leading authorities.

The chapter on Local Anesthesia is provided by Dr. M. L. Harris, of the Chicago Polyclinic, and is replete with valuable information. Harris is not only an adept in the use of local anesthesia but also a clever teacher and he manages to convey a great deal of knowledge and technic in a very limited space. After a general review of the underlying principles of local anesthesia, a consideration of the drugs used, their toxicity and the preparation of solutions of procain and apothsin, he details the various methods of injection and remarks on the preparation of the patient and the handling of emergencies and after-effects. He then explains the methods of regional anesthesia and their application to operations on the head, face, neck, upper and lower extremities, trunk and abdomen and concludes with a thorough exposition of sacral anesthesia.

Dr. W. Wayne Babcock, Professor of Surgery in the Temple University, Philadelphia, presents the subject of Spinal Anesthesia. Aside from a large previous clinical experience with this method, Dr. Babcock had an extended opportunity of trying out the method in war hospitals and much of his additional information is the result of that experience and the research that developed from it.

As spinal anesthesia is being advocated, more and more, under circumstances in which general anesthetics seem to be contraindicated, it is the discretion of valor for surgeons and anesthetists to perfect themselves in spinal anesthesia with as thorough an understanding of its possibilities and safeguards as Dr. Babcock has achieved.

Some explanation and apology would seem to be due the medical profession and the specialists in anesthesia by the Editors and Publishers of the Oxford Loose-Leaf Surgery for their apparent inability to secure the cooperation of some noted professional anesthetist to present the subject of Nitrous Oxid Anesthesia. It would seem that those concerned are permitting themselves to become part of a sinister propaganda to take the practice of anesthesia out of the profession, or if they are so ignorant of the real authorities on the subject as not to know whom to approach to secure presentation of this valuable method, they can inform themselves by getting in touch with the Secretaries of American, Canadian, British and Scottish Societies of Anesthetists.

## Quarterly Index

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## THE TREATMENT OF FRACTURES OF THE HUMERUS BY SUSPENSION AND TRACTION.

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The treatment of fractures of the humerus to be described was devised in 1914 in the Ambulance of the American Hospital of Paris, at Neuilly.

At first used to combat the swelling of the arm, forearm and hand so common in infected gun-shot fractures of the arm, its advantages in facilitating dressings and the very good reductions and early unions obtained, brought it into general employment for all fractures of the humerus, simple as well as gunshot. The chief objection to it has been the confinement of the patient to bed. This objection is valid in war only when the patient is treated in hospitals where evacuation of the wounded is necessary. The answer is that the very transportability of the wounded suffering from these fractures makes it possible to send them at once after being wounded to base hospitals in quiet zones which do not have to be evacuated. In such hospitals there is no objection to placing the patient in an apparatus unfit for transportation, and the more rapid union and earlier restoration of function obtained by the suspension treatment more than justify its employment.

In uninfected gunshot fractures we repeatedly observed union within twenty days and the patients were using their arms within thirty days. In civil practice we have found that union has been obtained and the suspension treatment discontinued, at least during the day, in an average of four weeks. I say "during the day" for it is desirable, if the patient uses a sling when up, to suspend the arm at night until he has full use of it.

The treatment is easy to apply to fractures of the humerus, not requiring nearly so much skill as does treatment by splints. No splints are used. Immobilization is achieved by traction aided to a certain extent by the way in which the limb is suspended. Although the fragments are efficiently immobilized one upon the other, yet motion is permitted at both the shoulder and the elbow. These joints, continually moving, never become stiffened, which explains the good functional results obtained.

For suspension some sort of frame is necessary. The so called Balkan frame is excellent but a gallows frame consisting of a post and arm is sufficient. When the latter is used, the post should be set above (anatomically speaking) and as near the head of the patient as possible, and the arm should correspond in direction to that in which traction is made so that the patient's arm can hang directly below it.

When using the Balkan frame, as the overhead bars to which the arm is suspended usually correspond to the long axis of the bed and not to that of the fractured limb, two bars should be used, one directly over the center of the arm, the other a few inches outside of it, so as to be vertically over the hand. A pulley should then be fixed to each of the bars at the points mentioned, namely one over the center of the arm, the other over the hand. Other pulleys should be fastened to the bars either at the head or the foot of the bed so that the weights attached to the suspension cords may be out of the way of the patient and attendants. The patient being in the bed, the limb is uncovered and the traction and suspension bands are applied.

These bands or straps may be made of Canton flannel or gauze to be glued onto the skin, of diachylon adhesive plaster or of ordinary Z. O. rubber plaster. One of the former is best, for the latter is apt to slip gradually. Still it can be frequently changed and, for the light work that is necessary in fractures of the humerus, will generally suffice.

The traction bands are applied to the inner and outer surfaces of the arm and their ends, narrowed to enter buckles, should extend for four inches below the elbow when the latter is flexed. They may extend a couple of inches above the fracture.

The suspension bands are applied to the flexor and extensor surfaces of the forearm, from the elbow to just above the wrist. Their ends, narrowed to enter buckles, should reach to the tips of the fingers.

A sling should be prepared for the arm. This is made of heavy muslin or duck; or, in case of a compound fracture necessitating wet dressings, of rubber sheeting. Its width should correspond to the length of the upper arm, that is about eight inches, and it should be about twenty inches long. Its ends are fastened to a stick which acts as a spreader, to



the ends of which the suspension cord for the arm is attached by means of a bridle.

It now remains to fasten the traction bands on the arm and the suspension bands on the forearm to their respective cords. The traction bands are buckled to a spreader of wood two inches wide and four inches long. These spreaders are kept in stock and may be used for the arm or leg. Through the center of the spreader a hole is bored through which the traction cord is passed and fastened by means of a topsail halyard knot. A piece of tape six inches long with a buckle sewed to each end is fastened to the spreader by tacks. The buckles therefore overhang the ends of the spreader by about an inch and when the traction bands are buckled the spreader will be about four inches from the elbow.

The spreader for the forearm suspension is mounted with tape and buckles in a similar manner but it is four and one-half inches square and, in addition to the tape, a piece of elastic webbing three-quarters of an inch wide and twelve inches long is passed over the spreader at right angles to the tape. The ends of the webbing thus lap over the sides of the spreader nearly four inches on either side. To each end of the webbing a round piece of wood (part of a broomhandle does very well), four and one-half inches long is fastened by a nail or strong tack. This piece of wood serves as a handle or hand-rest for the patient to grasp and exercise the fingers.

The arm is now suspended, using, as a rule, equal weights for both arm and forearm. Three pounds on each is an average weight. The traction should be about eight pounds at first for the average arm, which is diminished to four or five pounds as soon as reduction is obtained. Much more may be necessary for very muscular arms.

In all fractures, except those of the surgical neck in which the proximal fragment may assume a position of exaggerated abduction and outward rotation, the arm lies in a sling in a horizontal position and the forearm in a vertical position, the elbow being flexed to 90 degrees. In supracondylar fractures the lower fragment is apt to flex itself sharply so that there is an angular deformity forward at the fracture. This may be overcome by flexing the elbow to less than 90 degrees, which is done by moving the suspension pulley for the forearm toward the head of the bed.

Bowing forward is also corrected by increasing the suspension weights on the forearm and diminishing that on the arm. Bowing backward is corrected by the opposite, i. e., increasing the arm weight and decreasing the forearm weight.

In low fractures the direction in which traction

is made is of little importance for the stretched muscles about the long proximal fragment keep it in line with the distal fragment. In fractures at the upper

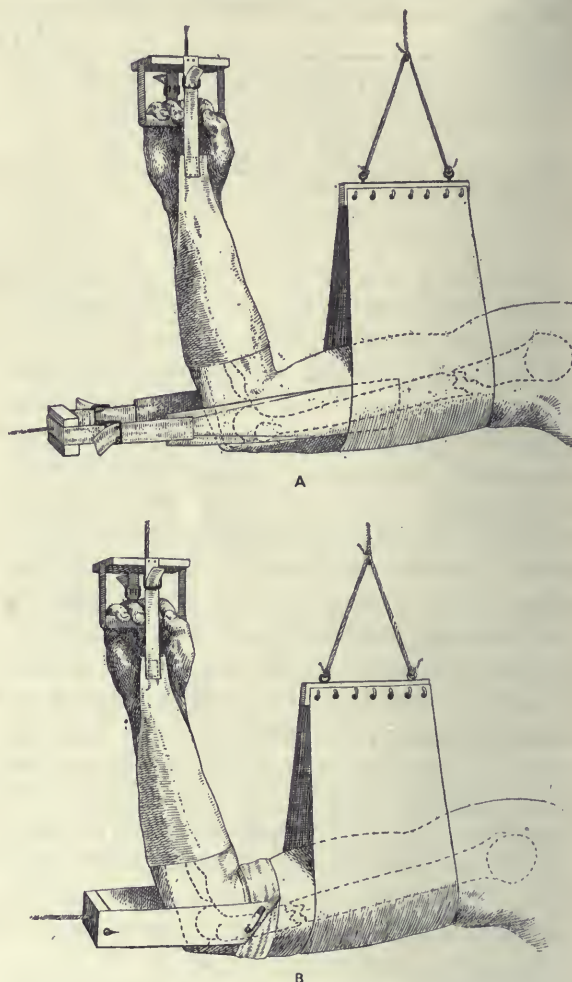


Fig. 1. Detail of Method of Suspension and Traction for Fracture of the Humerus.

Suspension of forearm is made by bands glued to skin and which are attached by straps and buckles to a wooden spreader. A round wooden handle is attached by pieces of elastic webbing to ends of spreader, thus enabling patient to exercise the fingers. The arm is suspended by a sling of duck, muslin or rubber sheeting, one end of which is tacked to one side of a wooden spreader; the other end is pierced with eyelets which hook over hooks on the other side of the spreader, so that the sling can be reduced for dressings. Traction in case of high fracture (A) is made by bands glued to the skin of the arm and attached by buckles and straps to a wooden spreader. In low fractures (B) by doubled band of muslin 6 cm. wide fastened as shown about the padded arm just above the elbow. The padding under the band has been omitted in the drawing for the sake of clearness. In practice the Dakin pad over the wound surfaces. Screw heads on the ends of the spreader button into holes in the ends of the band. (From Keen's Surgery, Vol. VII. Courtesy of W. B. Saunders Co.)

part of the shaft, particularly those above the insertion of the pectoralis major, the proximal fragment takes a position of extreme abduction and as it is impossible to control its position, the distal fragment



must be brought into line with it; consequently, as traction must be made in this line, the pulley over which the traction cord runs must be placed at right angles to the bed and in some fractures of the surgical neck even as much as 130 degrees from the line passing from the shoulder to the foot of the bed. In fractures above the insertion of the pectoralis major and latissimus dorsi, the proximal fragment is also rotated outward so that the distal fragment must be rotated correspondingly. This is accomplished, the patient being in the recumbent posi-

pulley over which the traction cord passes should be as far as possible from the elbow, because if close to the elbow movements of the patient will change the angle of traction to a marked degree. The pulley is the center of the circle and the traction cord the radius while the patient moves in the circumference, and therefore to prevent undue angulation the radius and circle should be as large as possible.

For low fractures the pulley may be put at the foot of the bed, but in higher fractures in which abduction is necessary some form of outrigger is neces-

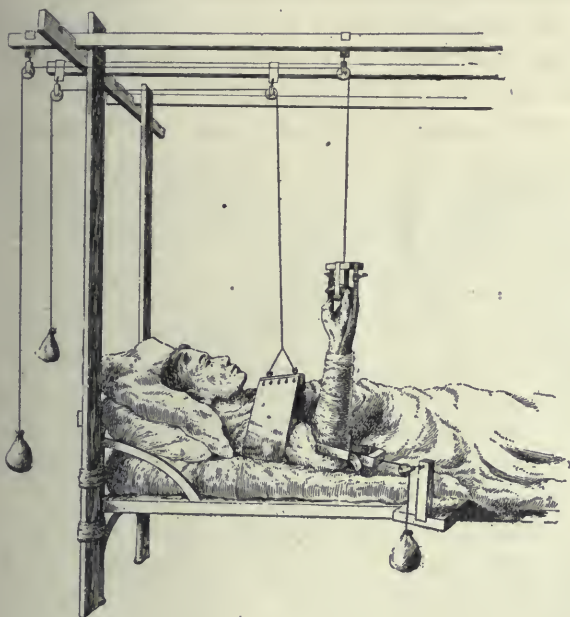


Fig. 2. Method of Installing Traction with Suspension for Fractures of the Humerus.

In this instance traction is made by bands glued to the arm and buckled to a spreader. The pulley for the traction cord is attached to the abduction board; the amount of abduction being adjusted by slipping the board in or out under the mattress. Note the arrangement for suspension, the hand and forearm being suspended in a plane lateral to that in which the arm is suspended. (From Keen's Surgery, Vol. VII. Courtesy of W. B. Saunders Co.)

tion and the forearm flexed to 90 degrees, by keeping the suspension pulley for the forearm in the vertical plane passing through the humerus and traction pulley until the direction of traction passes the angle of 90 degrees with the body. As the angle of traction has to be increased beyond this point it will be found the rotation outward must be increased also, so that in the extreme position of abduction and rotation out the arm and flexed forearm come to lie in the coronal plane.

The angle in which traction must be made to correct deformity, is determined by repeated x-ray examinations and, as the patient is in bed, a portable apparatus is necessary. It is important that the



Fig. 3. Method of Treating Fractures of the Surgical Neck of the Humerus.

Note the marked abduction and rotation out necessary to bring the distal in line with the proximal fragment. (From Keen's Surgery, Vol. VII. Courtesy of W. B. Saunders Co.)

sary. For abduction up to 90 degrees a board six to eight inches wide and about six feet long may be slipped across the bed under the mattress where it is held by friction, no other fastening being necessary. At the outer end of the board an upright about fifteen inches high is fixed, to which the traction pulley is fastened. By changing the direction of the board the proper angle of traction is obtained easily. For abduction greater than 90 degrees an outrigger is fastened across the headframe of the Balkan frame and the traction pulley attached to it. In these cases the suspension cord for the forearm passes over a pulley fixed to the headframe in order to obtain the necessary rotation out.

In all fractures treated by suspension and traction, motion is constantly occurring at the shoulder, from the patient's movements in bed. The patient should



also be encouraged to move the elbow, and the extent of motion should be gradually increased as consolidation progresses, so that when union is complete the motions of the articulations should be normal. At first the patient must be aided in making these motions by steadying the arm. While motion takes place at both shoulder and elbow the patients have no pain, proving that fixation at the point of fracture is good.

Fractures of the diaphysis may be treated by fixation in splints and the motions of the shoulder and elbow recovered after a period of physiotherapy, but we are all familiar with the disagreeable ankyloses following the splint treatment of fractures close to or entering the shoulder or elbow. Because of the constant motion taking place in the joints in the treatment by suspension no ankylosis need be feared, particularly if motions are systematically made.

One of the chief objections to fixation by splinting is the faulty reduction of rotary deformity in high fractures. The aeroplane splint, while correcting angular, does not provide for rotary deformity and in fact exaggerates it, so that many patients treated by this splint cannot move the hand away from the body when the elbow is flexed. To correct it with the aeroplane splint the elbow would have to be extended and the arm rotated out, or with the elbow flexed the hand would have to be carried above the patient's head.

The earlier union obtained by the suspension treatment can be explained by better fixation, but perhaps the chief cause is better nutrition due to maintenance of function and normal circulation.

#### POST-GRADUATE MEDICAL SCHOLARSHIPS

The New York Post-Graduate Medical School and Hospital announces that there will be available this year six scholarships under the terms of the Oliver-Rea Endowment. The purpose of the Endowment is to award scholarships to practicing physicians of the United States to defray in full the expenses of tuition at the New York Post-Graduate Medical School. According to the wishes of the donor, physicians in the State of Pennsylvania will receive preference in the award of these scholarships.

Applications may be sent to the President of the New York Post-Graduate Medical School and Hospital, 20th Street and Second Avenue, New York.

In all examinations of children, and in the examination of adults for suspected fractures, leave the painful manipulations for the last.

## FRACTURES OF THE HEAD AND THE NECK OF THE RADIUS.

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Fractures of the head of the radius are much more frequent than our present statistics would indicate.

Plageman, from the Rostock Clinic, found 23 cases in 3,664 fractures—1.65%. Thomas quotes it as occurring ten times in one thousand cases and considers fracture of the head and neck of the radius as more frequent than fractures of the patella.

The frequency of its occurrence is, however, not of as great importance as the failure to recognize the lesion once it has occurred.

One hundred and sixty-one cases have come under my observation. Of these ten occurred in children and the remainder were in adults. Twenty-six cases occurred in conjunction with dislocations at the elbow joint all in adults.

Previous classifications have divided the fractures of the upper end of the radius into those of the head and those of the neck. It would seem necessary, from the peculiarity of the region involved, to divide the fractures somewhat differently based more upon the relationship of the fracture line to the orbicular ligament and to the superior radio-ulnar joint.

In this paper I purpose to divide the fractures of the upper end of the radius into those which involve the radius within the joint capsule, and those which involve the bone between the capsule and the attachment of the biceps tendon. Many of the first group involve portions of the shaft and all produce disturbances of greater or less moment in the joint. The latter group are entirely extra-articular and are much less frequent in their occurrence. There are also marked differences in the symptoms produced, the treatment to be used, and in the result obtained.

The terms used in this paper will then be:

1. Fractures of the head of the radius. These include all those which occur in the region of the upper radio-ulnar joint capsule and include the epiphyseal separations.

2. Fractures of the neck of the radius. These include only those fractures that involve the bone below the region of the joint capsule and above the attachment of the biceps tendon. Tanton (*Nouveau Traité de Chirurgie par Le Dentu et Delbet*, Vol. IV, Paris, 1918, Vol. I; p. 542 et seq.) evidently makes the same division.

FRACTURES OF THE HEAD OF THE RADIUS. (GROUP I.) occurred 150 times in this series, divided as follows:



10 cases in children (epiphyseal separations).  
26 cases in adults in conjunction with dislocation  
of the elbow.

114 cases in adults without other lesions.

150.

FRACTURES OF THE NECK OF THE RADIUS. (GROUP II.) occurred eleven times in this series. All the cases were adults.

Mechanism: (Fractures of the head of the radius).

Thomas (*University of Pennsylvania Medical Bulletin*, Vol XVIII, 1905) concludes that the most frequent cause of this injury is a fall upon the hand with the elbow extended. In his experiments he followed Bruns' experiments by disarticulating the humerus and with the palm of the hand on the ground and the arm in extension struck blows upon



Plate I. Marginal fracture of the head of the radius in a woman aged twenty-five.

the head of the humerus. Thomas placed the forearm in nearly full pronation. He makes the point that the fragment which is anterior in pronation will be posterior in supination. The force applied to the head of the humerus in this way, by Thomas, smashed the humeral head without producing a fracture of the radial head. It was necessary to saw off the humeral head and apply the force (a blow with a mallet) to the sawed end of the humerus to produce the desired result. He succeeded in all except one of his ten attempts to produce a fracture of the head.

Von Lesser believed that forced flexion of the elbow, by drawing the radial head against the capitellum, produced the fracture.

Von Bergmann believed that the arm is in abduction when the fracture is produced by a fall upon the hand.

Stimson, Cheyne, Delorme report cases produced by direct violence over the head of the bone, and

Stimson believed that the fracture might be produced by forced abduction of the forearm.

The history of the method of reception is clear and sufficient to determine the method of production in only 70 of the above 150 cases.

In two cases the children were leaning over to pick up something and the arm was jerked forcibly upward (radial abduction plus forced extension) producing a fracture along the epiphyseal line.

In one case the patient was struck by a falling timber on the semi-flexed arm raised to protect his head and there was an abrasion of the skin with a



Plate II. Same type of fracture as in Plate I, except that there is a large gap between the fragments on the articular surface. This does not show in the lateral view. Function was more interfered with than in the above variety. Man aged twenty-eight.

contusion over the head of the bone. In the remaining sixty-seven the injury resulted from falls upon the hand with the arm extended and in various degrees of pronation.

Pathological Anatomy:

Tanton (*vide supra*) gives a classification headed as *incomplete fractures* or fissures which run longitudinally through the head and usually involve the neck. A lesion of this type does not appear in my series. Two cases considered incomplete fractures by me which were subsequently submitted to operation because of the functional disturbance, showed radiating fissures of the head which however completely separated some of the fragments and were types classified as B (*vide infra*).

It is not possible from the x-ray plate alone to



state that the fragments are not completely detached by the line of fracture, and, as this variety is not as a rule submitted to operation because of the mildness of the injury and its subsequent recovery without the necessity for operation, it would seem wiser to include this group with the following group.

#### COMPLETE FRACTURES OF THE HEAD:

This type includes a large number of lesions of a very different type. In general they may be divided into:

1. *Those in which the displacement is very slight and in which the injury to the surrounding orbicular ligament is practically nil. The lesion in the bone can best be shown by the following x-ray plates.*

Type A. (Plates I, II).

In this type a small fragment is broken from the



Plate III. (Type B) Note the same marginal fracture as is shown in Plate I, but with a second line of fracture through the neck with some displacement of the internal fragment.

periphery with some slight separation of the fragment from the bone and depression of the fragment downward. In the mid-position between pronation and supination this fragment is on the antero-lateral aspect of the head and involves only a small portion of the cup of the articular surface. (This type corresponds to Tanton's "Fractures Marginales").

Type B. (Plate III).

In this type the fracture line splits the head into a number of smaller or larger fragments which are but slightly displaced and there is a fissure which traverses the neck close to the attachment of the synovial membrane to the bone. This is a more severe injury than the previous one and there is apt to be some tearing of the orbicular ligament or the synovial membrane or both.

In one case (Jennie D., House of Relief, New

York Hospital, x-ray plate 1588) there was a fracture of a portion of the articular cartilage of the capitellum and this fragment lay on its edge between the fragments of the head of the radius with one edge resting against the fracture of the humerus. There was considerable tearing of the orbicular ligament (Plate IV).

In another case (Caesario, House of Relief, New York Hospital, x-ray plate 227, Plate V) submitted to operation, there was a coincident fracture of the tip of the coronoid process of the ulna, the fracture line involving the lesser sigmoid cavity of the ulna. The patient was an Italian aged forty-four, who



Plate IV. Fracture similar in type to that in Plate III, but with a shadow between the head of the radius and the humerus which proved to be a fracture of the articular surface of the humerus displaced between the fracture fragments of the radius (see text).

came to the Hudson Street Hospital with a history of having fallen down some steps, eighteen weeks before I saw him. He thinks his hands were in front of him. His arm was practically stiff, with no supination or pronation and about five degrees of movement in flexion and extension. At operation there was calcification of the anterior capsular ligament of the elbow and partial calcification of the orbicular and external lateral ligaments. There was also a healed fracture of the coronoid process of the ulna which was not visible in the x-ray plate. The head of the bone was broken into four or five fragments with very little separation of the fragments and with osteoid tissue springing from between the fragments which blended with the calcified ligamentous structure. The head of the radius, with the orbicular



ligament, and the calcified capsular and lateral ligaments, were excised. The resulting function six months after the operation was flexion, a loss of ten degrees, extension a loss of fifteen degrees with supination one-half normal, and pronation three-quarters normal, when the patient disappeared.

2. *Those with marked displacement of the fractured fragments.* (Plates VIII to XIV).

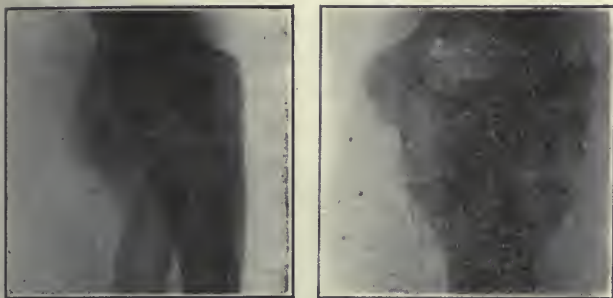


Plate V. Fracture of the characteristic type, but with ossification of the orbicular ligament, the anterior capsular ligament, and a portion of the external lateral ligament of the elbow joint (see text).



Plate VI. Epiphyseal separation in a girl of six, with the classical symptoms of injury to the head of the radius. The displacement is slightly outward and was not corrected. Function was practically perfect.

The fragments of the head may be one or many. Usually the line of fracture extends into the neck of the bone. The displacement of the fragments varies within wide limits also. It may be only a slight downward and forward displacement with rotation of one or more small fragments or a complete wide displacement of the head forward and laterally, sometimes as far as the internal condyle. In this variety

the orbicular ligament is extensively torn and the bone fragments preserve little or no contact with each other. There is also some laceration of the external lateral ligament of the elbow joint.

In this group also are found the fractures of the head of the radius which occur with the elbow dislocations, and in these (dislocations) one also finds the torn capsule and ligaments of the elbow joint common to those dislocations, in addition to the injury to the orbicular ligament.

The essential difference in the two main groups, I and II, described above, is not so much the extent of the bone injury as it is the amount and degree of injury to the orbicular and associated ligaments and to the superior radio-ulnar joint.



Plate VII. Complete displacement of the epiphysis treated by open replacement (see text).

#### *Epiphyseal Separations (Plates VI and VII).*

The epiphyseal line in children lies within or very close to the attachment of the synovial membrane of the superior radio-ulnar joint to the radius, so that these injuries are, in part at least, intra-articular.

Broca considers the lesion as a fracture of the neck but the symptoms (q. v.) are so similar to those of the fractures of the head, and the joint symptoms are so common that I believe they should be classified in this group.

The youngest child was three years of age and the x-ray plate showed a roughening about the epiphyseal line with but little displacement. In the other cases



the displacement was forward and outward, and in one case the head of the bone was displaced out and



Plate VIII. Note the wide displacement of the fragments. One fragment lies in front of the ulna below the inner edge of the trochlea.

down so that the cup of the articular surface pointed directly outward.



Plate IX. The same patient as Plate VIII five years after the operation. This plate shows very beautifully the amount of ossification which occurs when the torn orbicular is left untouched, and also shows the irregular growth of the cut surface of the radius when it has been covered by muscle. The function in this case was extremely good and the newly formed bone apparently interfered very little with the movements in any direction (see text).

It seems possible from the youngest case in this series that the "subluxation of the head of the

radius" described as a lesion in children under three years of age (Stimson, *Fractures and Dislocations*, Lea & Febiger, 1917, page 746 et seq.) may in certain cases be a separation of the epiphysis not readily detected even by the x-ray.

#### *Symptoms.*

The symptoms are fairly characteristic. Following the injury there is disability, more or less complete, at the elbow joint with inability to supinate the forearm. The arm is usually held in semiflexion and a little beyond the midpoint in pronation. Flexion and extension are possible but limited and somewhat painful, while pronation and, especially, supination are impossible without severe pain. Curiously enough, when the fragments are widely displaced



Plate X. Wide displacement of a large fragment.

the active movements in pronation and supination are relatively less painful than in the less severe injuries.

There is swelling in the cubital fossa and sometimes ecchymosis over this region, which later also appears over the external condylar region.

There is exquisite tenderness over the head of the radius increased by attempts at supination and made unbearable by abducting the forearm during this supination. That is, if digital pressure is made over the head of the radius and the forearm supinated and abducted there will be severe pain at the point of pressure, which may also radiate down the forearm. When such is the case a fracture of the head of the radius is always present, and no other lesion at the elbow joint will give the same symptoms.

I have never felt crepitus, perhaps because I have never looked for it. When the large fragments are widely displaced they may occasionally be felt, es-



pecially as hard movable bodies just on the outer side of the biceps tendon.

In children, especially young children, the disability is complete but the arm is usually carried by the side in extension in the pronated position, and movements from this position cause pain.

The actual diagnosis must of course rest upon an x-ray examination, although the above symptom-complex is sufficient for a diagnosis.

An x-ray plate, especially stereoscopic plates, will show the location of the fracture and the amount and degree of the displacement, and is essential for the proper treatment.



Plate XI. Note the similarity in the displacement of this fragment to that of the epiphyseal displacement (Plate VII).

#### *Treatment.*

The treatment of fractures of the head falls into three groups and, as stated above, depends upon the factors outlined in the classification above given.

Group 1, Type A.—the marginal fractures. The arm should be splinted with the elbow flexed to a right angle with the forearm in the middle position between full pronation and supination and kept at rest during the stage of acute exudation and reaction in the superior radio-ulnar joint. Arbitrarily I have kept the arm at rest for five days. Daily massage, with baking by dry heat, is then begun and the patient is urged to use the arm, that is to make active movements in flexion and extension within the limits of pain. As soon as the patient finds that these movements can be executed without pain, usually in from five to seven days (the tenth to twelfth day after injury) movements in pronation and supination

are encouraged and the splint is removed. The treatment is continued from four to six weeks, after which time more active movements on the part of the patient, with use of the arm, may be encouraged.



Plate XII. Note the rotation and upward displacement of a large fragment. The line of fracture was similar in character to that in Plate III, but with greater displacement of the fragments.

The average time consumed in the restoration of function to its final degree is eight weeks.

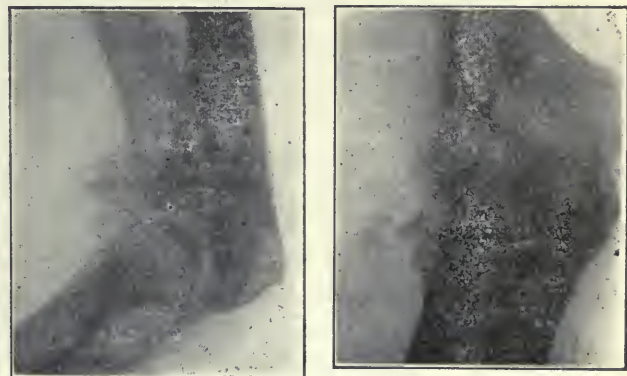


Plate XIII. An old case which shows displacement that was untreated. Also shows the proliferation of new bone with calcification of the ligaments. Greater disturbance of function after the operation than occurred in the cases illustrated by Plates VIII to XII inclusive, submitted to early operation.

The resulting loss of function for this group is relatively slight, about five degrees of extension and from five to ten degrees of supination. In women and children the loss in extension is less noticeable



than in the male adults due to the almost universal hyper-extension at the elbow in the former.

The splint used by me is a moulded plaster splint from the middle of the posterior aspect of the upper arm down the ulnar aspect of the forearm to the dorsum of the hand at the heads of the metacarpal bones. A well-fitting triangular sling is equally satisfactory, although the average patient feels more secure and better satisfied with the splint.

Operation is not indicated in this variety and any attempt at correction of the slight displacement which may be present is unnecessary.

In rare instances the small fragment may fail to



Plate XIV. Shows an old untreated fracture of the head of the radius as the cause for the stiff elbow. The patient had a fresh fracture of the humerus for which I saw him in consultation with Dr. L. A. Wing.

the removal of this fragment and refused. The removal of such a fragment would be the treatment for this rare complication.

Group I. Type B.—The early treatment is essentially the same as that described for the type A fractures, except that the hand should be carried into as much supination as the patient will permit. The recovery is apt to be less rapid and the function obtained is not so satisfactory as in the former lesion. The treatment usually requires from twelve to sixteen weeks before the restoration of function to its final stage.

Operation may be required for loss of function, especially supination, and for various complications, such as coincident fracture of the articular surface

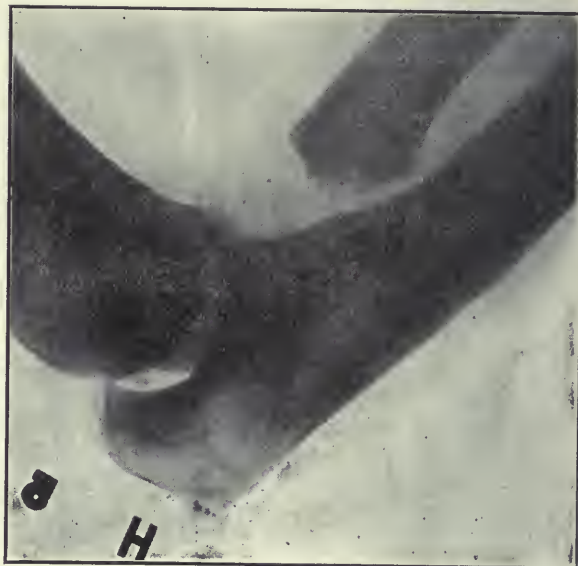


Plate XV. Shows the result of the ideal type of operation (aperiosteal division of the radius with excision of that portion of the orbicular ligament which was badly torn) (See text).

unite and become a loose body in the superior radio-ulnar joint and cause disturbance in that joint. Such a case came under my observation in the Out-Patient Department of the New York Hospital. The injury was an old one and probably belonged to this type. Following a fall, six months before I saw him, the man, about twenty-five years old, was treated for a sprain of the elbow. After about a month he began to use the arm with pain, especially on supination. This has persisted and is especially bad after his day's work. Examination showed little except slight limitation of extension and limitation of supination to about half normal. Forced beyond this point there was crepitation in the joint and some pain. The *x*-ray plate showed a small fragment evidently detached from the head in the joint. Operation was advised for

of the humerus, subsequent ossification of the joint capsule, etc. This is usually done late when it has been established that the above treatment will not suffice; and the method to be pursued will be described later.

There were 41 cases in this series that have been considered as Type B, with 7 operations. One was done on the seventh day after the injury (the case Jennie De C. with a coincident fracture of the articular surface of the humerus, Plate IV). The other six were for limitation of function, especially in supination and flexion, and all were markedly improved.

My experience leads me to believe that the time of election for the operation for the complicated cases in this series should not be later than the tenth week



after the injury, and should be done earlier if there is a coincident injury to the humerus (Plate IV). The result obtained, in my experience, is better in the cases operated upon at the end of eight weeks than those done later.

The criterion for operation is the failure to obtain a gradually increasing range of flexion, extension and supination. When this occurs, it is a nice point to decide whether to wait or to operate. If the individual is an artisan to whom the greatest obtainable function is a requisite, I believe operation is the method of election inasmuch as function is then more rapidly and more fully restored.

The resulting function for this variety (Group B) was a loss of extension of from five to ten degrees for the unoperated cases, and from ten to fifteen degrees of supination with a slight loss of pronation in one case. One case had only five degrees loss of supination and one case a twenty degree loss.

In the cases submitted to operation the best result was obtained in the case of Jennie de C. (Plate IV) submitted to operation on the seventh day. In this the loss of extension was five degrees, of supination between five and ten degrees.

Three cases operated upon before the tenth week had a loss of extension slightly less than ten degrees and about twenty degrees loss of supination.

Three cases operated upon later, eighteen, twenty, and twenty-four weeks after injury had between ten and fifteen degrees loss of extension, and about forty degrees of supination.

That is, the prognosis for function is relatively better for those cases submitted to the earlier operation.

There were 10 cases of epiphyseal separation in this series in children aged 3, 4, 5, 5, 6, 7, 8, 9, 9½ and 16. All were similar in type to that of the six-year-old child illustrated (Plate VI), except the youngest case in which only the epiphyseal line was hazy and the shifting of the epiphysis was comparatively slight, and that of the sixteen-year-old boy (Plate VII) in which the head of the radius was completely shifted so that it lay on the external aspect of the shaft of the radius with the cup of the head pointing outward. The symptoms in all were identical to those given above.

The treatment in all was similar to that outlined for the cases in Group I except that the arm was splinted at right angles in supination for a week, and then carried in a sling and the child encouraged to use the arm. Massage and baking were not needed and active movements were performed readily by

the children when the pain had disappeared. In the sixteen-year-old boy an open reduction of the displaced head was performed on the fifth day after the injury. The orbicular ligament was torn from the anterior edge of the ulna at the superior radio-ulnar joint and the capsule stripped from the neck of the radius. The external lateral ligament was also torn. The head was replaced and the torn ligaments imperfectly sutured with some difficulty.

The resulting function was practically complete for all of the children except the last-named case (the complete displacement). In this case extension

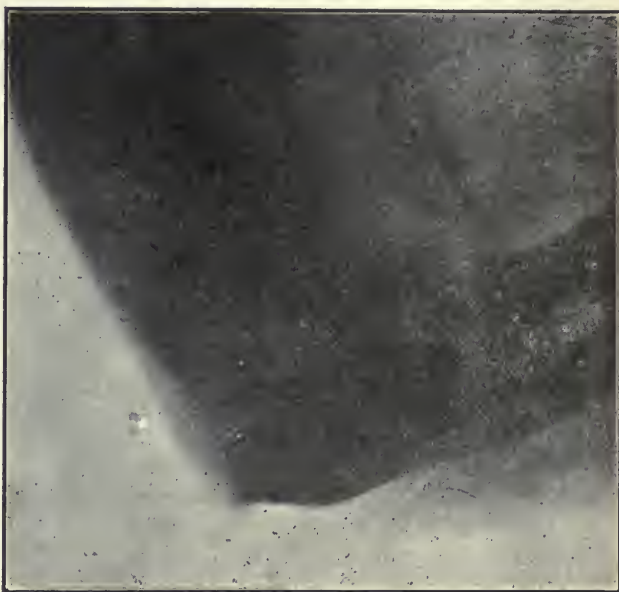


Plate XVI. Shows a myositis ossificans following a posterior dislocation of the elbow, mistaken for a fracture of the head of the radius. The case is unique in my experience.

and flexion were limited about ten degrees, pronation twenty degrees, supination twenty-five degrees.

Bolton, cited by Stimson, reported a similar replacement of the epiphysis but did not describe the resulting function.

In the fractures of the head with wide displacement of the fragments, there were 59 cases in this series with 58 operations. Twenty-six cases occurred in conjunction with dislocations of the elbow and 33 not associated with that lesion.

Because of the complicated tearing of the other ligaments of the elbow joint and the greater disability which results for that reason, the result of the treatment of the fractures associated with dislocation should be considered separately.

The lines of fracture in the head are numerous and are best described by the illustrations (Plates VIII to XIV inclusive).



The essential features of the treatment are removal of the head and neck as far down as the bicipital tubercle, and the operation should be done early—five to seven days after the injury.

The treatment of the torn orbicular ligament is a debatable question. If left as it is found at the operation or if closed by suture it becomes more or less completely ossified (Plate IX). This, however, has not interfered with the function in any of my cases.

The complete removal of the ligament is a rather formidable undertaking and in the one attempt I made I could not see any increased efficiency obtained by so doing. In general, I believe the best result can be obtained by simply excising the torn and shredded portions of the ligament and by leaving the remainder untouched and unsutured. I have also covered the end of the radius by fat, by muscle and by fascia,

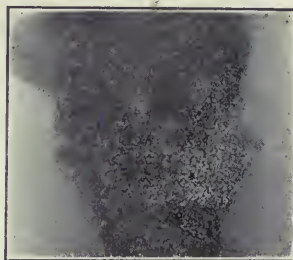
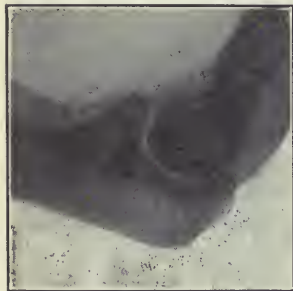


Plate XVII Fracture of the neck of the radius of the classical type.

but I believe that if it is treated by the aperiosteal method with removal of the marrow for a suitable distance (as in the aperiosteal amputations) the result is equally satisfactory (Plate XV).

Removal of the displaced fragment alone was done twice and the function was not nearly so satisfactory in these cases as in the complete removals (see Hitzrot, *Annals of Surgery*, Vol. XXXVII, page 354, for earlier report of 29 cases).

Forced movements at the elbow joint under an anesthetic are to be condemned. In one case in my series (Mrs. F., New York Hospital, 1920) the result of repeated efforts of this kind were an ankylosed elbow at the time the patient came under my care. Removal of the head and neck of the radius resulted in the return of all except ten degrees of supination, but flexion and extension were limited to about five degrees each way from a right angle by new bone deposited in the capsule of the elbow joint and were not improved by any treatment. This necessitated an arthroplasty with removal of the new bone and a portion of the articular surface of the

humerus and the resulting motion of twenty degrees in flexion beyond a right angle and twenty-five degrees of extension beyond a right angle, i.e., a range of forty-five degrees of flexion and extension is extremely unsatisfactory.

*Fracture of the neck of the radius* (Group II, Plate XVII) occurred 11 times in this series and is a relatively less frequent injury. In an earlier report by the author (*loc. cit.*) only 4 cases reported in that series of 10 cases really belong in this group. The cases all occurred in vigorous young adults and were produced by severe traumas. Seven of the patients fell from various heights and think they landed upon the outstretched arm. One patient fell and wrenched his arm between the rungs of a ladder, and in three cases there was a definite injury by a direct blow over the radial side of the injured arm in addition to an indirect twisting of the arm proper.

The symptoms are also different from the injuries of the head. There is disability with pain on pronation and supination, but flexion and extension are relatively painless.

There is no tenderness over the head of the radius in the cubital fossa but the tenderness seemingly lies beneath the long supinator muscle. The head does not rotate with the shaft and crowding the arm upward while supinating the hand produces pain below the elbow joint deep in the arm at the location of the deep tenderness and *not* over the head of the radius.

As a rule, x-ray examination shows a fracture about midway between the cup of the head and the bicipital tubercle in the narrowest part of the neck of the radius. The line of fracture is irregularly transverse and there is but little displacement.

In my earlier cases I put the arm up in a sugar-tong moulded plaster splint in the mid-position, but this I believe is not the correct method as there is always a loss of supination when the fracture is treated this way. My later cases were treated by supinating the forearm fully and by the use of anterior and posterior moulded splints from the middle of the upper arm to the middle of the palm. The splints should be worn for four weeks; massage and gentle movements of the elbow in flexion and extension should be started on the tenth day; and pronation should be begun after the third week. The splints may be removed at the end of six weeks but function is not fully restored before the tenth to the twelfth week. Attempts to correct the slight displacement are futile.

The resulting function is very satisfactory. Flex-



ion and extension are practically normal. One patient had a slight limitation of flexion. Pronation and supination are limited by less than five degrees. (In the 4 earlier cases supination was limited from twenty-five to thirty-five degrees).

Two patients had pain upon movements in supination. In one of these there was a definite arthritis in the inferior radio-ulnar joint, possibly the result of an old injury the nature of which the patient described as a sprain some ten years before.

The *x*-ray plates in this paper are from the Hudson Street Hospital and the New York Hospital and in large part were taken for me by Doctor Busby.

## FRACTURES OF THE FINGERS AND TOES.

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The surgeon practicing reconstructive surgery is occasionally confronted with deformities of the fingers and toes due to old undiagnosed or maltreated fractures of these members. Fortunately, the more universal early use of the *x*-ray and a better understanding of the principles of treatment of these conditions are reducing the time loss and deformities to a great extent. I have a number of these cases referred to me because of deformities following these fractures or because of prolonged disabilities. Numerous text-books on treatment of fractures are on our shelves and these deal with average cases. It is my intention, therefore, in this paper, to emphasize certain principles in the care of fractures of fingers and toes rather than to deal at length with the treatment of the various types of fractures.

The most important considerations in these cases are (1) diagnosis; (2) proper reduction and splinting with a view to obtaining perfect functional restoration; (3) treatment of the injuries to the soft parts which so frequently accompany fractures of fingers and toes, with the view of first saving as much function as possible in the tendons, nerves and muscles; the proper alignment and union of the fractures being of secondary consideration; (4) methods best adapted to overcome deformities and to restore function in the hand or foot.

### DIAGNOSIS

The classical symptoms of fracture of the metacarpals or metatarsals, as well as of the phalanges, are swelling, a point of tenderness over the seat of fracture, ecchymosis occasionally, and pain on manipulation of the corresponding finger or toe. Crepitus, in my experience, is not as frequently elicited as

some authorities state. Injury to the soft parts may cause swelling, tenderness, and pain on motion and may therefore conceal an underlying fracture.

All cases presenting the above classical symptoms, and all cases of injury to the soft parts, where the history indicates even moderate violence, should be at once submitted to an *x*-ray examination, although the roentgenogram will not always reveal the fracture unless taken in two directions—antero-posterior and lateral. This procedure will give the true diagnosis and will often show more than one bone fractured when only one bone was suspected. A routine *x*-ray examination of all hands in which one suspects fractures will fail to show a fracture in about 10% of cases, while all cases with swelling and tenderness in the foot following injury and subjected to *x*-ray examination will fail to show fracture in about 12% of the cases. The surgeon is scientifically and economically justified in subjecting his patient, an industry or the insurance company to the extra expense of an *x*-ray examination in those cases which fail to show fracture.

I have known insurance companies to complain of this apparently needless expense; but I have known the same companies to criticize severely a doctor who failed to take an *x*-ray picture at the time of injury because he didn't think there was a fracture, and yet 2 or 4 weeks later, because of continued tenderness and prolonged disability, an *x*-ray examination revealed the true condition.

I wish to emphasize, therefore, that in all cases of injury to the hands and feet, followed by swelling and points of tenderness, an *x*-ray examination should be made. In a small percentage of the cases a fracture will not be found but only in this way can the surgeon be sure of diagnosing all fractures that occur in these bones. Even when adhering painstakingly to this rule, a few of these fractures will be overlooked. But it is only after two or three experiences of being fooled by apparently trivial injuries to these parts that every physician becomes sufficiently wary to resort early to his roentgenograms.

After having completed my internship in the Cook County Hospital and feeling quite cocky on my ability to diagnose fractures, I fell down miserably in two cases during my first year of private practice.

Mr. P., a close friend, called at my office two days after a slight injury to his hand. While boxing he felt a severe pain in his hand. It had swollen slightly and was still a little painful, especially when tying his shoe laces or writing. The examination revealed very few signs and I diagnosed a sprain of the hand and bandaged it in order to keep it at rest. It still continued to pain him at times but he was satisfied



with my reassurances that it would get better. Two weeks later he called because of considerable swelling over the back of the hand and exacerbation of the pain. I then suggested an *x*-ray examination and this showed a transverse fracture of the third metacarpal just above the head of this bone.

Mr. F., another friend, called at my office one morning. He stated that in jumping out of bed he had sprained his foot. He was able to walk on it but this caused some pain. Examination showed no swelling but some tenderness over the fifth metatarsal. The trivial nature of the injury, the fact that he could walk, and the absence of definite findings caused me to concur in his diagnosis of a sprain. A few days later he came in my office with his foot in a cast and walking on crutches. Another and wiser surgeon had resorted to the *x*-rays and had diagnosed the transverse fracture just below the tuberosity of the fifth metatarsal.

Since then I have seen many cases of fractures of the fingers, the result of injuries received in boxing, ball playing or falling on the hands. These do not always give immediate symptoms and undoubtedly many such fractures go undiagnosed, gradually healing without treatment. But careful examination will reveal immediately the point of tenderness, a slight crepitation, and limited function—sufficient signs to warrant an *x*-ray examination. (Fig. 1).

Mr. C's case illustrates another type of injury in which the fracture might easily be overlooked. He had struck another man in the face, cutting the proximal knuckle of his index finger on the man's tooth. Three days later he reported to me with a badly infected hand which required opening and treatment for several days. There was no sign of fracture but because of the nature of the injury and because the swollen, infected soft parts precluded a careful digital examination, a roentgenogram was made which showed a fracture of the second metacarpal with decided angulation.

The fracture of the fifth metatarsal described above is not an uncommon result of some apparently trivial injury. Sir Robert Jones is said to have fractured his fifth metatarsal while dancing. Jumpers have been reported to sustain this fracture. One employee stepped on a crow bar and twisted his foot. It was days before he reported to the plant surgeon because of swelling and pain. Considerable ecchymosis was present and the *x*-rays revealed a transverse fracture through the tuberosity of the bone. The mechanism of this fracture is said to be pressure downward through the cuboid while the foot is supinated or a pulling motion on the attachment of the peronei brevis muscle.

The following cases illustrate various types of overlooked fractures of these parts that have come under my care.

A man whose thumb was struck by a falling box forcibly abducting the member. It was treated for several weeks as a sprain and referred to me because of stiffness and continued pain. *X*-ray examination showed a fracture through the outer half of the base of the first metacarpal, extending into the joint, with only slight displacement.

This is a frequent type of fracture of the first metacarpal known as Bennett's "stave" fracture. Speed\* described it as an "oblique fracture of the proximal end, the palmar fragment opening into the joint, and the distal portion being separated and dislocated backward to a varying degree." It often simulates a dislocation and differs from the separation of the epiphysis which has been described by Coues', Poland,† Sturrock and Speed.

"Stave" fracture of the thumb occurs from blows on the end of the thumb, or falls causing forcible abduction, or from direct violence over the joint. It



Fig. 1. Fracture of head of fifth metacarpal. At the time of injury a typical backward displacement of distal fragment simulated dislocation. The child's teacher reduced the apparent dislocation. Fracture not discovered until two weeks later when physician was consulted.

is comparable to fractures in the bases of the phalanges which are usually small cracks, accompanied by some dislocation, and which are spoken of as "base-ball fingers", due to the typical deformities which usually follow a strike on the end of the finger by a base ball. All of these are not fractures but many cases of fractures occur in the phalanges of ball players which are never diagnosed.

In industrial work it is very important to *x*-ray every case of injury to the joints that cause the pain and slight swelling so characteristic of a "base-ball finger". If you do not, some other doctor is likely to and you will be chagrined by having the employee report to his employer some morning that his family

\*Fractures and Dislocations, (Lea & Febiger, 1916), p. 530.

†Annals of Surgery, LVI, 450.



doctor found a fracture when you were treating him for only a sprain.

A child developed a spindle-shaped swelling about the middle joint of her index finger. There was no history of injury, no pain, no ecchymosis and no tenderness on pressure. She was treated for one week by her family physician for rheumatism. Then her parents consulted a pediatrician who thought that it was a case of spina ventosa and referred her to me. The swelling prevented the typical appearance of a spina ventosa, and when I referred her to the *x*-ray laboratory, I felt that this was probably the condition present. The roentgenogram showed a fracture of the proximal end of the middle phalanx of the index finger. This child was accustomed to turning hand springs and it is probable that the injury occurred in this way. There was some angulation and the correction of this, with immobilization for two weeks, gave a perfect result. Without proper diagnosis, the deformity in this little girl's finger would have been permanent.

I have seen some workers who have sustained apparently trivial injuries develop swellings about the fingers or the back of the hand, without any pain or tenderness, and who have shown a transverse fracture of one of the metacarpals or of a phalanx on *x*-ray examination.

This case brings out the importance of the *x*-rays in the differential diagnosis of these cases of swelling about the hands or feet due to some obscure cause. For example:

Mr. S., 50 years of age, a tailor, struck the back of his hand against a gas jet pipe when reaching for his pressing iron. The blow was not severe but two days later there was some swelling. I diagnosed a slight contusion and advised resting the hand. The next day the swelling had increased and an *x*-ray picture showed a needle buried deep in the soft tissues of the back of the hand near the wrist joint. The swelling soon showed signs of infection. It was opened and the needle removed. This was followed for several days by a severe infection of the hand. This man could not recall ever having run a needle into his hand and neither could his mother recall such an injury when he was a child. When the *x*-ray was resorted to my diagnosis was a possible fracture of the base of the 3rd metacarpal bone because of the swelling and tenderness over this area.

Mr. R., 18 years of age, fell on his extended hand while at work. The next day there was considerable swelling and he was sent to the hospital for *x*-ray examination. The laboratory reported a small crack in one of the carpal bones. The wrist and hand were immobilized but the swelling increased in size, fever developed and the appearance was that of an infection. Another *x*-ray examination was made with both hands and wrist joints on the same plate for comparison. This revealed a slight change in all the carpal bones of the injured member as compared with the other wrist. The bone which had been

diagnosed as fractured was now seen to be infected. Instead of a fracture we were dealing with a case of tuberculosis of the carpal bones, diagnosed within a week following a fall on his extended wrist. The process must have been present before this fall. This case illustrates the importance of reading and interpreting the *x*-ray plates yourself and also of taking a picture of the well member for comparison in case of doubt.

Mr. A., 47 years old, a butcher, twisted his foot while at work and it became badly swollen. He remained at home soaking it in hot water and rubbing it with liniment, under the care of his family physician, for five weeks. His employer grew tired of paying compensation for a simple sprain of the foot and so called to see me about it. I expressed the opinion that possibly his employee's foot was fractured and advised that an *x*-ray examination be made. A week later the case was referred to my service at Washington Boulevard Hospital. The *x*-ray examination showed a tuberculosis of all the metatarsal bones instead of a sprain or a fracture. The condition had undoubtedly been present prior to the slight injury complained of. Disability was greatly prolonged by lack of early proper diagnosis.

I have seen one case of swelling of the fifth finger, proximal joint, that developed after the girl employee had struck her extended finger against the typewriter. Pain and tenderness were absent. An *x*-ray examination was made at once and revealed a large bone cyst involving the entire proximal phalanx. This immediate use of the *x*-ray prevented a claim against the concern, for it was inconceivable that this slight trauma could have made this marked change in the bone. At the time the picture was taken I suspected a fracture.

Fractures of the phalanges very frequently accompany smashed toes due to heavy objects falling on them. These are very often undiagnosed. The crushed soft parts are treated but the fracture, undiscovered, is left to heal without treatment. Usually good union takes place but occasionally marked deformity results because of mal-union, non-union, or necrosis of the bone.

The case of Mr. M., 45 years of age, a trucker, illustrates this type of fracture. While at work a heavy truck passed over the toes of his right foot in November, 1920, crushing the soft parts severely. He was taken at once to one of our best hospitals by the insurance company. The surgeon to whom the case was referred was away and the interne placed hot dressings on the foot. The next day was Sunday and the surgeon did not visit the hospital. On Monday when he saw the foot the swelling had gone down and the soft parts were improved. The patient was kept in bed two weeks and then discharged as almost cured. As soon as he began to walk about, with the aid of a cane, pain and swelling returned in the toes. A few days later a small discharging sinus appeared in the end of the great toe and a little later sinuses appeared in the 3rd and 4th



toes. The company doctor treated these as infected soft parts. Under rest they would improve but when the man began to walk about they would grow worse. There was very little pain. This condition continued for eleven weeks before the insurance company decided to refer the case for special care. He entered my service in St. Luke's Hospital and an x-ray examination showed only a portion of the distal phalanx of the great toe remained acting as a foreign body; a necrosis of the distal phalanx of the 4th toe, and a necrosis of the distal phalanx and a portion of the proximal phalanx of the 3rd toe distal to an old trans-



Fig. 2. Crushing injury of the toes, eleven weeks after the injury. Possibly a fracture of the distal phalanx of great toe with absorption of the bone. Healed fracture of the proximal phalanx of the great toe. Ankylosis of the joints of the second toe. Fracture of the second and distal phalanx of third and fourth toes, with infected processes active in the ends of the bone. Ununited fracture of the second phalanx of the fifth toe. Discharging sinuses in first, third and fourth toes. Infected soft parts excised and necrotic bone removed. Left open and healed by granulation.

verse fracture. The soft parts over these necrotic bones were infected. Removal of the dead bones, trimming of the soft tissue and leaving the wounds open to heal by granulations resulted in complete recovery in three weeks and the return of this employee to work. (Fig. 2)

This is not an uncommon history except that it is unusual for these cases of phalangeal fracture of the toes to pass through a good hospital undiagnosed. This fact adds emphasis to the importance of x-ray-ing all crushing injuries of the toes.

Fractures of these phalanges are usually trans-

verse or oblique; occasionally a portion of the bone is fractured off and remains ununited. Longitudinal fracture through the phalanx of the great toe is not infrequent. Speed reports an interesting case of the distal phalanx of the great toe being split into 4 pieces by longitudinal fractures. The blood supply in the phalanges is not rich—the distal phalanx having no periosteum. Therefore, it is not uncommon for non-union and necrosis to follow in the distal fragment of these fractures. Early diagnosis, proper alignment and keeping the patient absolutely off the injured foot for three to four weeks will usually result in union; but when signs of necrosis or persistent non-healing of the soft parts occur, removal of the fractured fragment is indicated and will hasten recovery.

Undiagnosed fractures of the metatarsal and other bones of the foot result in a greater degree of permanent deformity and a longer period of disability than do the undiagnosed fractures of the hand. This is due to the trauma to the fractured parts from weight-bearing. I have seen disability prolonged for more than a year, the result of undiagnosed fractures in the feet, and permanent deformity was the final result.

Mr. B., 32 years old, had his right foot crushed by a large amount of crushed stone falling on it. It was badly swollen and contused, when he was admitted to the hospital, and ice-bags were applied. Four days later a cast was applied without an x-ray examination being made (according to patient's statement). The foot became badly swollen and turned black and the cast was removed at the end of 4 days. After 2 weeks he was allowed up on crutches. The swelling and dusky color in the foot persisted and at times caused great pain. Treatment consisted of alternating rest in bed with hot dressings or ice-packs and periods of being up and around on crutches. This man was referred to me exactly ten months after the injury. He then had a slightly swollen foot, cyanotic, with ischemic and trophic changes along the outer lateral surface and a small pressure ulcer just back of the little toe. The toes were stiff and there was practically no lateral mobility in the foot. Flexion and extension of the ankle were limited. X-ray examination showed a fusion of all the metatarsals with a chronic infective arthritis between the metatarsal and tarsal bones. Signs of transverse fractures through the tuberosities of the metatarsals and through the cuboid were found. All fractures had united but the bones were plastered together by this infective exudate. Lack of diagnosis and allowing the patient to bear weight on these fractured bones had resulted in an otitis and arthritis which in healing had permanently deformed the foot.

Severe crushing wounds of the hands or feet are



practically always accompanied by one or more fractures. One metacarpal or metatarsal may be fractured in two or three places. The determination of whether or not effort to save a hand or foot should be attempted depends partly upon the condition of these bones. Therefore the *x*-ray should be resorted to as soon as feasible in all these severe crushing injuries.

Severe injuries to other parts of the body may be accompanied with injury to a toe or finger resulting in fracture which is overlooked because the surgeon's attention is focused chiefly on the major injury. During the last year I have seen a case of severe skull fracture with a fractured phalanx of the 3rd finger; a case of ruptured liver with a fracture of the 5th metacarpal; and a case of severe contusions of the chest and back with a fracture of the 2nd metacarpal. In all cases of severe injuries careful examination of all parts of the body should be made. The surgeon should develop a system whereby he routinely examines an injured person thoroughly and completely and not the least of his attention should be directed to the fingers and toes.

Fractures of the great toe sesamoid bones, a rudimentary 6th metatarsal, tearing off a chip of bone from the joint surface with a dislocation of a phalanx, and other atypical fractures must be definitely diagnosed by roentgenograms.

The chief points to be emphasized, therefore, in the diagnosis of fractures of fingers and toes are:

- 1—A majority of these fractures give the classical symptoms of swelling, point of tenderness, ecchymosis or crepitus, but in these the *x*-ray must be resorted to in order to determine the type, number and location of fractures.
- 2—A considerable number of these fractures occur in cases where the history of injury or the findings are slight and, because the case hardly justifies the expense of an *x*-ray examination, the surgeon diagnoses a "sprain" or a "contusion". Later, because of persistent symptoms the *x*-ray is used and the surgeon is chagrined to find that he has overlooked a fracture.
- 3—The early use of the *x*-ray is indicated in all cases of swellings and points of tenderness following an injury to the hands or feet; and in all cases of swellings and points of tenderness, without history of injury, that are not definitely inflammatory changes or ganglions or tumor formations in the soft parts. The *x*-ray is necessary for differential diagnosis in some of these. (Fig. 3).
- 4—Many cases of fractures of fingers or toes are

overlooked because of the severe injury to the soft parts. In all such cases roentgenograms are indicated.

- 5—Failure to early diagnose and properly treat some of these fractures results in prolonged disability and occasionally in permanent deformities.

#### TREATMENT OF CLOSED FRACTURES.

The treatment of fractures of the fingers and toes is most important, especially in industrial surgery, where much of the worker's skill may be lost by poor results. The greatest care should be used in setting these fractures and after reduction the result should be checked up by *x*-ray examination.

These fractures have been considered as minor injuries and too little attention has been paid to their treatment. The fees allowed by insurance companies for such fractures has relegated their care to the hands of unskilled physicians. For the same reason



Fig. 3. Contused and lacerated wound of back of hand. The patient entered with hand badly infected and *x*-ray examination showed fractures of fifth metacarpal and distal phalanx.

the *x*-ray has not been used sufficiently often to check up the results. The expense column has controlled the treatment of these cases to a too great extent. Surgeons should be paid more for the care of these fractures. At the same time insurance companies and employees and also the patients must be educated to the importance of using the *x*-ray to diagnose and to later guide the treatment. It would help considerably if a reduced charge could be made for fractures of the fingers and toes by *x*-ray laboratories, thus allowing two or three small plates to be made in all of these cases. The reduction of these fractures



under the fluoroscope is the most ideal plan that can be adopted. The portable x-ray apparatus is especially well adapted for this work.

Light plaster of Paris splints that can be moulded to suit any desired position of flexion or extension of the hand or fingers make undoubtedly the best universal method of holding these fractures. Splints are far preferable to casts, especially for fractures in the hand, as they can be easily removed and daily or every other day massage and joint motion allowed. Every type of metal splint recommended for use on the hand can be patterned out of plaster—the wide wrist band, the palm support, the long narrow strip for the finger, the Goldthwaite thumb splint (fig. 4) or the Jones shoehorn splint. Steel bars,  $\frac{1}{8}$  to  $\frac{1}{4}$  inch size, can be readily bent to fit any position and incorporated in the plaster splint and extended beyond it, thus forming excellent means for traction. Sir Robert Jones in his new work on Orthopedic Sur-

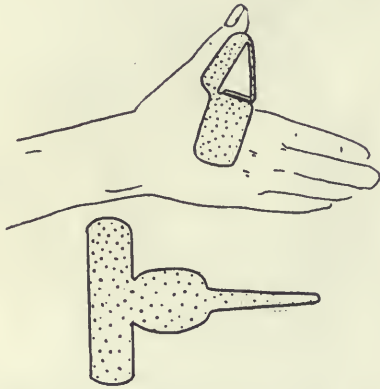


Fig. 4. Goldthwaite's thumb splint cut out of sheet metal and folded to fit thumb. (Speed)

gery of Injuries gives an excellent description of this method.

The majority of the fractures of the fingers and toes are transverse or oblique, and because of the proximity of the other bones the displacement is usually not marked. In such cases the part is held by a splint, in as nearly normal position as possible, care being taken to prevent the bandages or the pull of the muscles or tendons from causing a displacement later.

In those fractures with displacement, careful traction and pressure and other manipulations must be used to reduce the fracture and gain proper alignment. In some cases this may require a gas anesthesia but as a rule pressure pads, continuous traction and splinting of the part in the best physiological position to give the desired end will suffice.

In the Bennett "stave" fracture of the thumb the best position is to splint the thumb in abduction and

flexion. Jones says to have the thumb in the position assumed in grasping a tumbler. A plaster spica about the thumb may suffice. If there is much displacement of the fragment, traction should be used. Two adhesive strips wrapped spirally around the thumb and attached to a rubber band or tube and the latter attached to an extension on the splint will give excellent traction. This extension can best be made by using a U-shaped steel rod; apply a plaster splint to the back of the hand with a slide splint over the back of the thumb; incorporate one leg of the U in the palmar portion of the splint and one in the thumb portion. The Goldthwaite thumb splint (Fig. 4) or a pattern of this made of plaster, forms a good means of holding these fractures, as well as fractures in other portions of the phalanges of the thumb.

In fractures of one or more of the metacarpals



Fig. 5. Fracture of second phalanx of index finger after two weeks' treatment in complete extension. Note forward angulation which fixation in partial flexion would have overcome. Antero-posterior view appears normal.

there is a tendency for the distal portion to displace dorsalward and override the proximal fragment. A pad in the upper palm and a second pad over the lower back of the hand with a posterior plaster splint extending from three inches above the wrist down to the proximal phalanges of the fingers will usually suffice. If traction is necessary, use can be made of the spiral adhesive strips about the corresponding finger, attached by rubber bands to an extension similar to the steel rods described above, which are incorporated in the plaster splint. In case of traction the fingers should be somewhat flexed. Some authorities claim that traction on the fingers is not well tolerated but if released daily and massaged, trouble will be obviated.

The rule is for a fracture of a metacarpal just above its distal end to show marked dorsal displacement of the lower fragment thus simulating a dis-



location (Fig. 1). This is especially true of the fifth metacarpal and less often of the second. Pulling downward firmly the corresponding finger, and at the same time flexing it, will usually correct this deformity. Then the hand should be splinted with the fingers forcibly flexed about a roller bandage placed in the palm. This draws the extensor tendons taut over the fragment and usually gives perfect alignment. A plaster splint moulded over the back of the hand and around the flexed fingers or simply bandaging the hand in this position or the use of a strong adhesive plaster will hold the fracture. Care should be used in fractures of the second or fifth metacarpals that a tight bandage around the hand does not



Fig. 6. Marsee's tin finger splint.

cause lateral displacement of one of the fragments.

Fractures of the proximal phalanges of the fingers should always be splinted with the finger completely flexed in order to avoid the angularity which usually occurs when splinted in extension. This angularity is due to a forward pull of the interossei muscles on the proximal fragment when the fingers are extended.

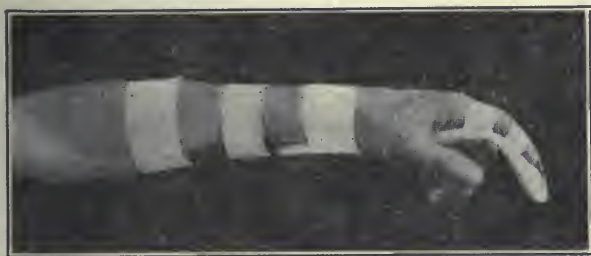


Fig. 7. Method of application of Marsee's finger splint before bandage is applied. Note natural curve of finger.

If healing is allowed in this position, this deformity occasionally prevents the complete flexion of the finger afterwards. Here again the roller bandage in the hand with the finger on either side of the injured one flexed with it may be best utilized.

In fractures of the two distal phalanges a natural flexion of the fingers is the best position for immobilization. I have seen in a few cases an angularity develop with the distal fragment forward at its upper end when the fingers were held in complete extension. (Fig. 5). This is an argument against the use of the tongue depressor as a splint unless it is so well padded as to give a double inclined plane effect.

Marsee's tin finger splint, the long arm of which can be bent in the desired position of flexion, forms one of the best means of immobilizing fractures in the two distal phalanges. Here again I often use the moulded plaster splint. (Figs. 6 and 7).

In fractures of the metatarsals manual reduction is usually necessary if there is dorsal overriding. Traction is harder to obtain through the toes. For the first or fifth metatarsal a moulded lateral splint extending partly over the sole and partly over the dorsum furnishes excellent immobilization. If all the metatarsals are fractured, as often happens, careful reduction should be followed by holding the foot at right angles, padding the arch and encasing the foot and ankle in a plaster cast. (Fig. 8) This can be cut along its anterior aspect so as to be spread apart and removed like a shoe for massage after the fourth day. When replaced it can be held snugly by adhesive strips. I have already mentioned the importance



Fig. 8. Multiple fractures of foot treated by immobilization in a light cast.

of removing fragments or all of the distal phalanx in case of necrosis of the bone following fracture. This does not as a rule interfere in the function of the foot and will frequently save weeks and weeks of disability due to infection of the soft parts and persistent sinuses in the ends of the toes.

In fractures of the sesamoid bones efforts should be made to hold the fragments together with strong adhesive tape; keep the patient off the injured foot as in fractures of the other bones of the foot. The mistake is usually made in these cases of treating this injury as trivial and allowing the patient to use the foot too soon. In case of non-union and of persistent pain over the site of the sesamoid it should be removed. It is best to remove both of the sesamoids of the great toe if one must be removed as the other tends to drop down and cause trouble.

From two to three weeks must usually elapse before union is sufficiently strong in fractures of the fingers to permit discarding all splints. In the toes



three to four weeks is a safer period and certainly the patient should not be allowed to walk on the injured member earlier if such complications as painful, excessive calluses or infection of the bone are to be avoided in all cases.

#### INJURIES TO THE SOFT PARTS ACCOMPANYING FRACTURES.

Severe crushing injuries of the hand and foot with laceration and tearing of the muscles, tendons, nerves and bloodvessels as well as several fractures and displacement of the fragments of bone are of frequent occurrence. Many of these are so mutilated that amputation at once is necessary. But one is not justified in performing a classical amputation, cutting away sufficient injured tissue to enable making good skin flaps and a beautiful closure. In doing this



Fig. 9. Severe crushing injury of hand with multiple fractures. (Case of Dr. A. E. Halstead, St. Luke's Hospital.)

parts of the hand or foot are often removed which with care and patience could be saved and often would be of inestimable value to the patient later. A general rule should be adopted in these cases somewhat as follows: Cleanse the crushed member thoroughly with tincture of iodine, or with neutral soap followed by Dakin's solution as a wash; trim away as little of the mutilated tissue as possible; leave the wound wide open, introducing from one to eight Carrel-Dakin tubes into all the recesses and cavities of the wound; encase the hand in long sterile roller gauze dressings and about this place a large Carrel pad folded over the tubes and held in place with clothespins; place the injured member at rest somewhat elevated and preferably in a fracture box. Following this dressing, from 5 to 10 c.c. of Dakin's

solution should be introduced into each tube every two hours. The dressings should be changed two or three times a day when saturated. Each day the mutilated member is carefully examined and when it is evident that a toe or a finger or a part of the hand or foot is completely dead, that portion may be trimmed away, usually without an anesthetic. Never attempt to make flaps but leave the wound wide open and continue Dakin's solution until healthy granulating tissue has appeared. If infection occurs, which is rare under this treatment, the wounds must be left open longer. Usually at the end of a week one has removed all tissue which could not live and he has to deal now with clean, although ragged, soft tissues. Plastic surgery can now begin, and it is surprising how much of a badly mutilated hand or foot can be saved and can be remodeled so as to give good function in the remaining portion. Fig. 9 illustrates a case of this type.

Mr. G. was recently admitted to St. Luke's Hospital on the surgical service of Dr. A. E. Halstead. (Fig. 9). Although the hand was so badly lacerated that immediate amputation through the base of the palm seemed indicated, yet no tissue was removed at the first dressing. The crushed hand was thoroughly cleansed with neutral soap and Dakin's solution, and three Carrel tubes inserted from the wrist down to the finger tips through and under the lacerated tissue. The next day it was evident that the tips of the third and fourth fingers were not viable and these were removed. On the third day the hand was badly swollen, and for one week a severe infection was present. The Carrel-Dakin treatment was persisted in, however, and gradually the infection was overcome. Most of the soft tissues had been torn away from the fifth finger. This finally had to be sacrificed. Gradually better alignment was obtained in the remaining three fractured fingers, the soft parts healed, and at the end of four weeks this man was undergoing massage and passive and active motion, and within a few weeks will, undoubtedly, have a remarkably good functional result, considering the seriousness of the injury.

I could give numerous examples illustrating the value of delaying amputation in these cases of severe crushing injuries of the hand or foot accompanied with fractures of the fingers or toes. In most of these crushing wounds, the following rules should be observed:

(a) Do not amputate and close the stump with nice skin flaps at once.

(b) Cleanse the wound thoroughly and apply that form of dressing which will prevent infection.

(c) Ligate bleeding arteries if necessary, but do not attempt immediate suture of torn tendons nor manipulation of the injured tissues, in order to reduce or secure alignment of the fractured bones.



(d) At each subsequent dressing, remove all tissue that is non-viable, but continue to leave the wounds wide open.

(e) When only healthy, non-infected tissues remain, plastic surgery on the soft parts and reduction of the fractures can be undertaken.

Compound fractures of the bones of the fingers or toes occasionally occur without serious injury to the soft parts, except the protrusion of the bone at the site of the fracture. Such fractures should be at once reduced and the wound to the soft parts cleansed thoroughly with iodine, or preferably with Dakin's solution. I am Dakinizing all such wounds for a period of three or four days before closing them; the fracture, however, is immediately reduced and immobilized by one of the methods described in the treatment of closed fractures.

#### RESTORATION OF FUNCTION

Surgeons have devoted almost their entire attention to standardized methods of reducing and splinting fractures and have neglected many of the therapeutic adjuncts of the greatest assistance in restoring function and securing rapid recoveries. Stimulated by the reconstruction work in the army, the profession today is paying great attention to the various types of physiotherapy. Massage, hydrotherapy, especially hand and foot whirlpool baths, and passive and active exercises, are the chief aids in restoring early function in fractured fingers and toes. Patients allowed to remain in splints or casts for three or four weeks without any massage or passive movement will often require three or four weeks more before they can flex and extend their fingers or before they can walk on their foot without pain and swelling. Massage and passive movements carried on simultaneously with the treatment of the fracture will, as a rule, restore function in the part within four weeks.

The commonest deformities following these fractures are ankylosis of a joint, due to a fracture in the joint and its involvement in the healing process; union between two of the metacarpals or metatarsals due to excessive callus; loss of extension of the fingers due to contraction of the muscles; adhesions of the tendons to the skin or bony structures; peri- or intra-articular adhesions; lesions of the ulnar or median nerve; loss or limitation of flexion due to adhesions of the tendons to the skin or their involvement in the callus, or due to peri- or intra-articular adhesions or to traumatic or postural contracture of the muscles; and deformities of the hand or foot, result of severe crushing injuries with fracture.

Persistent massage accompanied by hydrotherapy will overcome the majority of these deformities. Oc-

cupational therapy and mechanotherapy are of great value in these cases. Tate McKenzie, in his book on "Reclaiming the Maimed", describes many ingenious mechanical outfits that will assist in securing flexion and extension of the fingers and of the toes. Joseph M. Flint, in *Surgery, Gynecology and Obstetrics*, 1916, Vol. 23, p. 228, describes simple mechanotherapeutic apparatus for mobilization of fingers:—

"For flexion and extension of the fingers two types of apparatus were generally employed. One was copied from a machine which I used in the gymnasium as a boy. This consists of a series of wooden cylinders of gradually decreasing size arranged somewhat in the manner of a towel rack. The smaller cylinder is perforated and a cord passes through the hole and is tied. On the other end of the cord hangs a can of gravel which serves as a counter-weight. The action of this apparatus is obvious. The patients begin on the larger cylinders to wind up the counter-weight which is in turn unwound by manual movements. After beginning with the larger cylinders, those of the smaller size are progressively used. This machine provides an excellent exercise for the wrist as well as the fingers.

"Another appliance for the fingers consists of a set of wooden cylinders each of which is covered by a cuff into which the fingers are inserted. By an angle of counter-weighted bands acting on these cuffs the fingers are held against the cylinders. This apparatus is then set in motion by a heavily weighted pendulum, which causes the cylinders to move back and forth through an arc of about 60°. As flexion of the fingers is gradually regained, smaller cylinders are successively used until both flexion and extension are complete."

In the United States Army, a heavy, well-fitting glove with leather straps attached to the end of the glove fingers and extending back through buckles at the wrist of the glove, was utilized for the gradual flexion or extension of stiff fingers. I have used this with great success in my private work since the war. The leather bands are fastened on the back of the glove when extension is desired, and on the palmar surface when flexion of the fingers is sought.

Forcible flexion or extension of stiff fingers under anesthesia is rarely indicated. As a rule, great swelling follows such procedure and the deformity is only intensified. Gradual methods of securing flexion or extension should be employed. The power that it is possible to exert without causing pain is very great and it can be graduated to a nicety. Whatever gradual method is adopted should be so arranged that the motion gained is never lost, and the traction on



the fingers is continuous. Daily massage and passive and active movement are absolutely essential parts of such treatment.

Operative procedures are occasionally indicated in order to overcome some of these deformities and restore function following fractures of fingers and toes. For example, tendons involved in the callus or adherent to the skin should be dissected free. Whenever possible, a pedicled flap of fat should be interposed to prevent re-adhesion of the tendon. Tendons that have been injured may require splicing or stretching. I have not found tendon grafts as successful in lengthening tendons as splicing.

Arthroplasty of the interphalangeal joints is indicated if deformity is due to a bony ankylosis. This operation can be performed under one-half per cent. novocain, a small fragment being removed from both bones or one-third of an inch can be removed from one of the bones only. A pedicled fat or fascia flap or free fat and fascia flap from fascia lata may be interposed. There has been considerable discussion as to the viability of these flaps. I have performed this operation several times, and believe in every case that the flap has become necrotic or absorbed. I have personally had no experience with heteroplastic substances, such as Cargile's membrane, pig bladder, boro-glyceride, etc. Results indicate that arthroplasty of these ankylosed finger joints is justified in efforts to restore function.

Occasionally ankylosis of the great toe joint following fracture of the first metatarsal will cause such pain and deformity that excision of the head of the metatarsal is indicated. I have removed the entire fifth metatarsal in a marked angular deformity of that bone with good result.

No treatment of fractures of the fingers or toes should be considered complete until every method has been exhausted for the best possible restoration of function in these members. Only in this way can the desired economic end-result be obtained.

122 SOUTH MICHIGAN AVE.

#### AMERICAN MEDICAL EDITORS' MEETING.

The 52nd annual meeting of the American Medical Editors Association will be held at the Hotel Lenox, Boston, Monday and Tuesday, June 6th and 7th, under the presidency of Dr. H. S. Baketel, editor of *The Medical Times*. At the sessions, which will be open to the profession, there will be symposia upon "Group Practice and the Diagnostic Clinic" and "The Attitude of the Profession towards Health Centers."

## CENTRAL DISLOCATION OF THE HIP.

With Report of Three Cases.

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CINCINNATI.

Central dislocation of the hip is a descriptive title applied to those fractures of the acetabulum in which the force has been long enough continued or is sufficiently great to carry the head of the femur mesially, this is, through the acetabulum into the cavity of the pelvis. Fractures of the pelvic ring are relatively common and sufficiently characteristic to present few difficulties of diagnosis, but indiscriminate grouping of all fractures of the pelvis under the one classification of "pelvic fractures" will do little toward a development of a higher diagnostic art, and add little to the knowledge of acetabular fractures. So fractures of the acetabulum must be viewed as an entity having peculiar characteristics.

Specializing of our knowledge is again desirable because the satisfactory treatment of a fracture today presupposes a knowledge of: the force or violence producing that lesion; the location and type of the fracture; the pathway taken by the dislocated fragments; the anatomical obstructions to a replacement of those fragments; the forces tending to maintain the parts in mal-position; all the possible complications as well as the mechanical principals needed for a retention of the parts in a corrected position. Fortunately several of these requisites have been satisfied through the information given us by the modern roentgenologist; also he is rapidly changing rare clinical entities from curiosities to conditions of clinical and forensic importance.

In 1788, Callisen first described this condition and some thirty years later Sir Astley Cooper reported a case in detail. Occasional cases were reported from that time on to date and the most complete report with summary of the reported cases (53) appeared in the *Northwestern University Medical Bulletin*, June 1909, by Schroeder. However, all of these cases are not strictly speaking proven central dislocations of the femur. Since Schroeder's summary there are not sufficient reports to bring the total over 75 so that one is justified in considering this a rare condition. A number of text-books do not mention the condition at all as, for example, Scudder's "Treatment of Fractures" and the "Oxford Loose Leaf Surgery".

The acetabulum is a deep hemispherical cavity with a raised border; it is composed of parts of the ischium, ilium and pubes; the ischium contributing most and the pubes the least. The lines of union are



roughly Y-shaped and frequently in the younger subjects fracture follows these sutures. The floor of the acetabulum is very thin, even translucent, and the thinnest part is the lower portion, while the upper and posterior parts are the strongest. It will therefore be seen that the relation of the head and neck of the femur to the acetabulum is very important and only when the leg is in abduction is there the greatest pressure on the thinnest part of the acetabulum. Violence, to reach the acetabulum, must be directed through the femoral head; it is therefore indirect except in those almost theoretical cases of a possible missile injury direct to the acetabular wall. Investigation of the studied case histories shows that the violence has consisted of falls on one or both feet or knees and in most instances falls on the side of the hip, the force being applied through the trochanter. This injury has been compared to the driving on of a hammer or axe-head by striking on the end of the handle. After the injury has occurred and the femoral head lies within the pelvis all the muscle groups, flexors, extensors, abductors, adductors and rotators about the hip act to continue and increase the displacement, and this force must be overcome for satisfactory treatment. This muscle force is greater than that about any other fracture of the body.

Henschen gives a very satisfactory classification of these cases as follows:

- (1) Central acetabulum fractures.
  - (a) Simple radiating non-depression Y-fractures; linear or semicircular fractures.
  - (b) Fragments displaced inward with subluxation of head.
  - (c) Fragments completely displaced—dislocation of the head.
- (2) Excentric fracture of rim.
- (3) Ring-like separation of acetabulum with displacement inward of acetabulum and head. (Not a true central dislocation as acetabulum itself is not fractured).
- (4) Combination of any of the above with fractures of the pelvic ring. Complicating injuries to soft parts and viscera.

I have tabulated some 56 cases from the literature, many of which are not proven true central dislocations of the femur. Of this number but seven were females; this however, means only that man's work produced situations of greater liability. Six of 45 cases, where the age is given, were under 20; 16 between 20 and 30; 9 between 30 and 40; 4 between 40 and 50; 6 between 50 and 60. In no instance was the injury classified as direct, and in but 8.1

per cent. was the force described as being applied through the feet or knees. In the remaining 90.9 per cent. the force was transmitted through the trochanter.

A great many of the earlier case histories omit the mention of many symptoms recorded in the more recent ones. Two inches is the maximum amount of shortening, though in a large majority the presence of at least some shortening is indicated. The "flattening" of the trochanter, or a "sunken" trochanter, is perhaps the most characteristic single symptom and a disturbance of the relation of the trochanter to Nelaton's line is constantly present, as is also Allis' sign.



Fig. 1. P. M. B. No. 3484—Acetabular fracture of first degree with simple radiating fracture of acetabulum. No luxation of head.

Inversion of the foot is reported but eversion is the more constant symptom. The absence of crepitus is frequently commented on with surprise. In practically all cases of more recent years the rectal and vaginal examinations have disclosed tenderness over the acetabulum or the bulging mass of the dislocated bone. All active motions are limited by the patient because of pain and reflex spasm, but when one picks up the leg he is surprised to find passive motion in all directions not limited but freely possible. Very considerable pain is complained of not only about the hip but also referred to the knee.

The brutal violence of the force that produces a central dislocation of the hip is so extreme that many times immediately fatal trauma is produced through



injury to the large bloodvessels or the hollow pelvic and abdominal viscera. Later fatal complications due to infections may cause death. Pelvic ring fractures may be multiple due to transmission and expenditure of the force along the various bony arches of the pelvis. One can thus see that in addition to the symptoms of the central dislocation *per se* there may be added all the variety of complicating symptoms associated with the great number of not infrequently coexistent injuries. It is safe to say that the prognosis as to life is good provided the associated injuries are of themselves not fatal. Prognosis as to the function depends, in the fully developed dislocation, upon an early recognition and correction of the deformity. Delay means the ankylosing of the femoral head in the faulty position with a ring of callus thrown out by the acetabular fragments. A few of the histories state that the individual is completely crippled and in one museum specimen the femoral head is embedded in a mass of new bone within the pelvis. In the uncomplicated case seen early and cared for promptly and efficiently the functional result is surprisingly good. Some pain is complained of and a slight limp may persist.

In making a differential diagnosis an impacted fracture of the femoral neck and the other forms of dislocation, particularly the "pubic" variety must be considered. Also multiple fractures of the pelvic ring are to be thought of and the possibility of a central displacement of a part of the pelvis due to multiple fractures or association of these with the true central dislocation must not be lost sight of.

The treatment of the simple case consists in lateral traction and longitudinal Buck's extension and counter-extension to overcome the muscular pull. A reduction of the bone through the hole in the acetabulum can best be accomplished with the leg flexed at right angles to the body and a pull up on the leg made together with the lateral pull and counter pull. At least three assistants are needed and the patient can best be handled upon the floor. Weights sufficient must be applied to accomplish the desired result. Proper lateral traction is hard to maintain because of pressure on the vessels and nerve trunks. In the second case here reported this was overcome by using a padded circular plaster cuff around the upper thigh. Passive motion should not be started until the acetabular callus is sufficiently strong to bear the pull of the muscles.

CASE I. (Reported by me in the *Lancet-Clinic*, 1915, Vol. CXIII, p. 392.)

On February 5, 1915 W. G., (Cincinnati General Hospital, No. 192141,) male, 49 years of age, while

at work on a ladder fell 15 feet striking on the left hip, chest and elbow. Could not get up because of the pain in his hip. He was admitted to the East Surgical Service just before the moving to the New City Hospital Buildings. Examination of his left leg showed about three-eighths of an inch shortening. The position of eversion was more comfortable though he could rotate the leg to the inverted position with pain. Pain about the hip produced fully 50% loss of function but passive motion could be made. No crepitus could be detected and there was no dislocation or swelling about the left hip. The trochanter was less prominent than that of the opposite side.

X-ray examination showed a fracture of the left acetabulum with a central dislocation of the head of the femur of about one-half inch. Rectal examination elicited marked tenderness in the neighborhood



Fig. 2. Case 3. H. C. No. 67556—Acetabular fracture of second degree with fragments displaced inward and subluxation of the head of femur.

of the acetabulum. No extension was used. Sand bags were used about the leg. He was kept in bed eight weeks.

Under date of March 10, 1915 the history record states "Patient has almost full motion of left leg"; under date of April 6th "Full function with slight tenderness"; under date of April 26, 1915 "Patient discharged. Full function, though has pain up and down leg to knee". I regret these x-ray plates were lost in the confusion of the moving of the Hospital.

CASE II. On June 6, 1920, Mrs. E. N., (No. D3727) age 40, was admitted to the City Hospital on the Second Surgical Service with a history of having fallen two and one-half stories to the pavement while cleaning windows. We do not know where the greatest blow was given. She was unconscious for a short time. Temperature 95°, pulse 128, respirations irregular. Later she was delirious. Marked echymosis about and subconjunctival hemorrhage of left eye developed and she gave evidence to warrant a diagnosis of fracture of the base of the skull in the anterior fossa. This latter was later con-



firmed by the x-ray examination and during the next six weeks there developed a complete atrophy of the left optic nerve. She had no light perception and no pupillary reaction and today is totally blind in the left eye. The right eye remained about normal.

The shock was such that our first attention was directed to combating this and no extensive manipulation or examinations were made in the first few days. A rather extreme Colles' fracture of the left wrist was put up in a temporary splint, and sand bags were placed about the right leg and thigh. No swelling existed about the hip. The right leg was almost two inches shorter than the left. The foot was held in eversion though it could be passively rotated, but this caused great pain and muscle spasm about the hip. So, too, flexion, adduction and abduction of the thigh were possible. The fascia lata was relaxed and the first impression was that of a fracture



Fig. 3. Case 2. Mrs. E. N. No. D3727—Acetabular fracture with true central dislocation of the femoral head. Picture taken after first attempt at reduction.

of the femoral neck. After the primary shock was improved the "sunken" position of the trochanter was noted and led to the suspicion of a central dislocation; on vaginal examination the large rounded mass of the femoral head and acetabular fragments could be readily felt in the right side of the pelvis. This was tender and slight crepitation could be detected, but no crepitus was noted at any time from the manipulation of the thigh.

X-ray report, made June 7th: A fracture of the right acetabulum with the head of the femur forced through the acetabulum into the pelvic cavity. No evidence of injury to femur. There is also a fracture of the ischium". (fig. 3)

Four days after admission, under ether anesthesia,

the effort was made to withdraw the femoral head from its pelvic position with partial success, as the x-ray plates show. Very considerable force was needed and used both laterally and in the long axis of the body; at the same time pressure was made from within the vagina but this was not great as we feared laceration of the soft parts by the bony fragments. Two weeks after admission a second anesthetic was given and the greatest improvement was accomplished with the thigh flexed at right angles to the body. (This fact is commented on in the case report of Dr. Wm. Fuller, *Journal of the A. M. A.* 1911, 141, p 390). The pelvic mass largely disappeared as well as the shortening. Buck's extension was applied, together with lateral extension outward of the injured thigh, with counter lateral weight extension applied to the pelvis just above the trochanter. We endeavored to keep these weights up to 20 pounds as she was a large well-muscled woman, but these were frequently reduced temporarily because of the bitter complaint of the patient.

Extension as above described was continued for about six weeks. Then passive motion was begun at the hip. She was allowed up after twelve weeks and discharged in four months. During the last month, gymnasium exercises greatly helped in a return of function in the hip. She was walking with crutches when she left the hospital. Last week, about 9 months after her injury, I saw her and with a three-eighth inch raised heel, she walked splendidly with but very little limp, and no pain except that in bad weather, or after unusual effort, the pain, referred to the knee, was quite severe. Measurements from the anterior superior spines to the internal malleolus was 94½ cm. on the left and 93 cm. on the right side.

CASE III. On October 25, 1918, H. C., No. 67556, male, age 48, was admitted to the First Surgical Service, Cincinnati General Hospital. I am not familiar with this man's history as I did not see him and the history on record is incomplete, so that I can give only a few of the details and show the x-ray picture (fig. 2) which is interesting and represents the second class of acetabular fractures. His injury was caused by a fall of 12 feet off of a trestle, alighting on the left hip. The tentative diagnosis was, as so often is the case, a fracture of the neck of the femur. He was in bed for some six weeks, was allowed up a couple of weeks before discharge and had only a rather marked limp at the time of discharge.

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- (7) Holmes, T. Tr. Path. Soc. Lond. 1887-8. V. 39. p. 231-235.
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THE WHITMAN ABDUCTION METHOD IN  
THE TREATMENT OF HIP FRACTURE.

ROBERT T. PIRTLE, M.D.,

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The Whitman method of abduction in the treatment of fractures of the neck of the femur represents nothing new, but the subject is so extensive that it can always be discussed with advantage. I have been familiar with this method of treating femoral fractures for eighteen years and have employed it with uniformly good results.

One of the primary objects in the treatment of fracture is the restoration of function. Whitman claims, however, that this purpose has never governed the treatment of fracture at the femoral neck, ostensibly because: (a) the mechanical conditions would make it impracticable, (b) it would endanger life, (c) the tissues would be incapable of undergoing the necessary reparative process. Moreover, any attempt to restore complete function would be futile, because the means at our command were inadequate in actual application.

The foregoing statements may be readily verified, since the basis of all treatment in common use is traction on the fractured limb. Traction properly applied and supervised may be efficient in the treatment of fractures of the shaft of the femur, the muscular tension thus produced materially aiding in the production of proper alignment, and security is assured by the formation of external callus. Traction is not efficient, however, in fracture of the projecting neck as it can at best only appose the fragments in a lateral and therefore insecure relation. Repair is not aided by external callus, but must proceed from within, and therefore a type of fixation is required that can be secured only by direct pressure.

To show how some of the earlier writers on the subject considered fractures of the hip, I quote a few:

- (1) Restoration of form and function is rarely to be attempted or even sought.
- (2) The first indication is to save life, the second to get union, the third to correct or diminish displacement.
- (3) It is a crime to disturb an impaction in reasonably good position.
- (4) Intracapsular fractures are practically never united by bone.
- (5) Our prognosis must always be unfavorable. In many instances the injury proves fatal, and in all the function of the limb is forever impaired, no matter whether the fracture has occurred

within or external to the capsule. Whether it has united by ligaments or bone, shortening of the limb and lameness are the inevitable results.

The universal outcome of the different methods of treatment may be appreciated when it is remembered that of one hundred and twenty ununited fractures of the hip observed at the Mayo Clinic not one had been treated by the Whitman method. Willis Campbell, of Memphis, reports one hundred and fourteen cases of fracture of the femoral neck. Of these twenty-nine were central or intra-capsular and were treated by the Whitman abduction method. Twenty-four gave good functional results, by which is meant that the patient walked without support, pain or discomfort and there was every evidence of bony union. The treatment resulted in failure in four cases, and the outcome was unknown in one. He also reports a series of forty-four cases of ununited fracture of the neck of the femur all of which were central, not one trochanteric or subtrochanteric being found. Of these sixteen were treated by Buck's extension, nine by the application of a plaster cast without regard to reduction or the position of abduction, four by Hodgens' splint, nine by sand bags, two by osteopathy, one ambulatory. In five the diagnosis was not made and consequently no treatment was applied.

Whitman claims that if the fragments are brought into correct anatomic apposition, there is no age limit to the possibility of union. On my service at the Louisville Public Hospital, early in 1920, I saw a woman aged one hundred and six years with hip fracture. Her youngest daughter was seventy-five years of age and so feeble that she was unable to visit her mother at the hospital. This patient was treated by the Whitman abduction method with the head of the bed elevated. At the end of six weeks when the plaster was removed firm union had occurred, but I regret to say she died within ten weeks from the date of fracture. Some one suggested that possibly she may have died from old age!

Non-union of hip fractures in children was one of the things which caused Whitman to seek some method of fixation so as to bring the fragments into correct anatomic apposition. That was about 1890, long before the surgeon considered it safe to open joints or even nail the fragments together. Twelve years afterward he first applied his abduction method, and it was a little later that I had the pleasure of working with him.

From my own experience and the observations of others, I believe the method of treatment that will relieve pain and shock, prevent bed-sores and at the same time promise the patient restoration of func-



tion, is much more conservative from a life-saving standpoint than neglect and its consequences represented by some of the plans now in vogue.

In the Whitman method the injured limb is covered with a stockinette or a flannel bandage which extends from the toes to the axilla; all bony prominences are well padded with cotton or silence cloth which is soft and does not become packed; the padding and bandages must be smoothly applied as every wrinkle will cause increased pain. This dressing should be worn for eight to twelve weeks. A general anesthetic is always administered while the dressing is being applied. Ether or nitrous oxide gas and oxygen may be satisfactorily used for this purpose. The patient is then placed on a Hawley table by preference if one is available. A pelvic support, or an ordinary flatiron with the handle padded, is placed under the buttocks to elevate the body slightly from the table, the shoulders resting on a hard pillow or box of the same height as the pelvic support. With two or more assistants the injured leg is abducted to the extreme limit, i. e., 45°; the sound limb is also abducted in like manner to fix the pelvis. Traction with internal rotation of the foot is then applied upon the injured side, and a plaster of Paris bandage adjusted extending from toes to axilla, great caution being exercised that the plaster is made thickest at the hip and knee joints which are always the two weakest points. Another feature which tends to make the dressing more comfortable is to cut the plaster around the thigh and pelvis. With this dressing properly applied the patient can be turned from side to side, or on his face, without the least discomfort; he can also be placed in a wheel chair with a board of suitable length to support the injured leg and taken out of doors when the weather permits. With ordinary care, which can be given by members of the family under direction of the surgeon, the patient can be kept comfortable. A bedpan can be placed under the body and removed without causing pain or inconvenience.

After the plaster is removed the patient remains in bed for several weeks. Each day the leg is abducted to the limit and massage practiced, the knee joint moved, etc. Weight-bearing is not permitted until there is free and painless motion and it seems certain firm bony union has occurred. Of course this is best determined by roentgen ray examination. If this method is not available then the surgeon must consider the ability of the patient to move the leg without pain, and the position of the foot on the injured side which should remain upright with little muscular effort, in estimating the amount of bony

union. I do not consider one year any too long in which to secure a satisfactory result in fracture of the hip.

Some of the advantages of the abduction method are: (1) there is no shortening of any consequence, (2) the lessening of pain and ease of handling the patient, and (3) the high percentage of satisfactory function secured.

The surgeon need have no fear about applying this method of treatment regardless of the age of the patient. The administration of morphine will not be necessary, and if the patient is given proper care there will be no bed- or pressure-sores. In the aged I sometimes place the hip in slight flexion to insure greater comfort while the patient is "propped up" in bed; but, as already stated, the head of the bed can be elevated ten or twelve inches and the same result secured. Some of the instrument houses made a portable hip extension apparatus which is very strong and may be advantageously used if desired while the plaster dressing is being applied.

#### INTERTROCHANTERIC (PERTROCHANTERIC) FRACTURE OF THE FEMUR.

Based on a Study of 120 Cases.

KELLOGG SPEED, M.D., F.A.C.S.

(From the Surgical Department of Rush Medical College, and the Cook County Hospital)

CHICAGO.

Apparently there has developed a misunderstanding of just what an intertrochanteric or pertrochanteric fracture of the femur is, and how often it occurs. The old distinction between intra- and extracapsular fracture of the neck of the femur has been dropped by men who know. We do hear of fractures through the narrow portion of the neck, near the head, and of those through the base of the neck. This study was therefore undertaken to attempt to demonstrate the relative frequency of intertrochanteric fractures and to give a general review of 120 cases. An investigation of that number was considered sufficient on which to base some general conclusions.

Sir Astley Cooper, in his "Fractures and Dislocations" (New Edition 1844, p. 152, Marvin, Boston, and on through into his Fifth Edition, 1851, p. 183) describes this type of fracture from a post-mortem specimen. Smith ("Fractures in Vicinity of Joints," Dublin 1854, p. 95) also describes them and Hamilton in his "Fractures and Dislocations" (Sixth American Edition, Lea's Sons & Co., 1880) calls them fractures through the trochanter major and



base of the neck of the femur, mentioning but five known cases, none of them his own. In his description of fractures of the neck of the femur without the capsule (ibid, page 419) Hamilton says "These fractures may occur at any point external to the capsule, but generally the line of fracture is at the base, corresponding very nearly with the anterior and posterior intertrochanteric crests. Almost invariably the acetabular penetrates the trochanteric fragment in such a manner as to split the latter into two or more pieces. The direction of the lesions in the outer fragments preserves also a remarkable uniformity; the trochanter major being usually divided from near the center of its summit, obliquely downwards and forwards toward its base, and the line of fracture terminating a little short of the trochanter minor, or penetrating beneath its base; while one or two lines of fracture usually traverse the trochanter major horizontally." Hamilton's description, then, of fractures of the neck without the capsule about corresponds with our modern idea of intertrochanteric fracture. In 1895 three other authors mentioned this type of fracture: Bennett (*Brit. Med. Journ.*; 1895, II, 893); Stokes (ibid, page 881); and Kocher (*Ann. Suisses d. Sc. Med.*, 1895, III, No. 72). It has been named after one of them, Kocher. Other references: Cotton (*Boston Med. and Surg. Journ.*, 1916, CLXXV; 439); Gerster (*American Journ. Med. Sciences*, 1913, CXLVI, 172). In 1916 this fracture was described and illustrated thoroughly in my text-book on "Fractures and Dislocations" (Lea & Febiger, 1916). Again in 1920 I called attention to it in my report before the Fifth International Surgical Congress in Paris and also in an article this year (*Archives of Surgery*, II, 45). Solitary cases have been reported by Wilensky (*Surg. Gyn. and Obst.*, 1920, XXX, 244); Wassink (ibid XXXI, 636), and Skillern from Muller's service at the Polyclinic Hospital, Philadelphia (*Annals of Surgery*, LXXIII, No. 2, 227).

**Definition:** Intertrochanteric fracture of the femur is that fracture in which the main plane of bony separation passes from the tip of the greater trochanter obliquely downward and inward to or through the lesser trochanter. Depending on the degree of violence in the cause, there may be impaction of the acetabular fragment into the shaft fragment or a comminution into two or more distinct fragments.

**Incidence:** In a consecutive series of 501 fractures of the femur admitted to the Cook County Hospital, Chicago, intertrochanteric fracture occurred 120 times, or 24% of all fractures of the femur. In a slightly different series of 526 cases

of fracture of the femur at this hospital collected by me, intertrochanteric fractures occurred in 118 instances or 22% (*Archives of Surgery*, II, 45).

**Age:** The average age of these 120 patients was 62.1 years. Only one case occurred in the first decade of life, and only 3 in the second decade.

**Sex:** There were 71 males, 49 females in the series.

**Mortality:** Of the 120 patients, 20 died, a mortality of 16.2-3%. Of these, 9 were in females, 18.4% of all females; 11 deaths were in males, 15.5% of the males. There were no deaths from fat embolism in the series.

**Cause of Fracture:** A large majority of the patients gave a fall onto the hip as the cause. They fell off steps, off street cars, downstairs, or off low elevations. All instances of intertrochanteric fracture arising in the younger patients (below 30 years of age) gave a very definite history of severe direct trauma. The only very young patient (a six-year-old boy) fell out of a swing from considerable height, landing on his hip. Amongst the 3 cases in the second decade of life, one fell 20 feet from a roof onto a cement sidewalk and the 2 others were struck in the hip region by automobiles.

**Methods of Treatment:** The treatment offered these 120 patients was:

Rest in bed .....	65
Buck's extension and bed .....	23
Plaster of Paris cast with legs in abduction .....	31
Open operation .....	1
(screws and bone peg both inserted)	

**Results:** All patients surviving (100), except one, obtained bony union. This one was recorded as having a fibrous union. However, as only 6 weeks had elapsed between the time of fracture and discharge in this particular case, judgment could not sensibly be passed on the type of union present. In all instances the bony union was checked by clinical examination and skiagram.

A small amount of actual shortening— $\frac{1}{4}$  to  $\frac{3}{4}$  inch—was the usual result. All patients surviving were able to leave the hospital walking on crutches or by aid of a cane after an average stay of 8 $\frac{1}{2}$  weeks. The functional use of the hip joint was generally restricted, but promised to increase rapidly. Apparent shortening was very rare.

**Mechanism:** A glance at the neck and trochanteric region of the femur demonstrates at once the following points:

The head is rounded, covered by a thin shell of cortical bone, whereas its inner mass is composed of



closely meshed cancellous or spongy bone. Its function is to permit the ball and socket hip joint motions and to transmit force of weight bearing or trauma



Fig. 1. A. Showing inter- or pertrochanteric area of a femur through which a saw was passed.

B. The sawn open intertrochanteric area. Note the large surface of cancellous bone exposed by a straight plane through this region. A bony union following fracture here would be expected regardless of treatment followed.

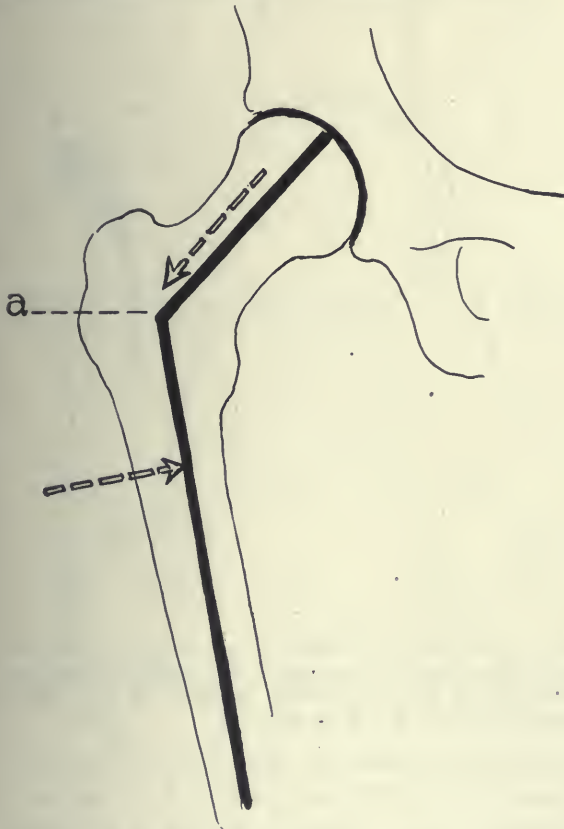


Fig. 2. Schematic representation of lines of force affecting femur in fall on the hip when the thigh is held tensely in slight abduction and external rotation by the muscles attached to the greater trochanter. The body weight passes down through the neck of the femur; the force liberated by striking the ground with the hip and thigh sharply adducts the thigh as indicated. The bone consequently bends and tends to give at "A", the apex of the convexity of the bone, and separation will start at or near the summit of the greater trochanter. Note the change in the long axis of the femur at "A".

coming from either below upward or passing from above downward through the leg. The neck is

similarly constructed, strengthened by bone trabeculae laid down its longitudinal axis and by the calcar femorale. The trochanteric portion of the bone is broadened and roughened, affording knobs for muscular attachments to the flexors at the lesser trochanter and the strong abductors and external rotators of the thigh at the greater trochanter. In addition to muscular attachment we have the powerful Y ligament attached in this area in front. Bigelow (*The Hip*) states that this is the strongest ligament in the whole body and that its function is one of checking extreme motions of the hip, the inner band restricting the extension of the femur and the outer band, outward rotation. The trochanteric portion of the bone is also spongy, meant by nature to take up stresses and strains, and to pass on force without losing its continuity. This area then is an *extremely powerful portion of the bone*, built to resist shocks and pulls when they are applied in the normal and usual direction of weight bearing and muscle stress, a fact to which I have called attention in discussing the applied physics of human bone. (*Surgical Clinics of Chicago* 3, No. 4, August, 1919, p. 1007.) (See fig. 1). However this thick cancellous portion of the bone is also the part in which the direction of the longitudinal axis of the bone changes. That is, the direction of the long axis of the neck must turn through an arc of 50 degrees to pass on down in the direction of the longitudinal axis of the shaft of the femur. This is shown by the normal angle of the neck onto the shaft equalling 130 degrees. (See fig. 2). The intertrochanteric area consequently must also be extra strong to transmit forces either up or down the longitudinal axis of the femur through this portion which takes a small turn around the corner.

In discussion of the mechanism of intertrochanteric fracture, Wilensky says: "It seems most probable that the injury results from a play of force in which an extraordinary overextension of the trunk at the hip joint occurs in the dorsal direction with, and upon, the lower limb as a relatively fixed pivot; an enormous strain is transmitted through the unyielding Y ligament which, while incidentally aiding the muscles very powerfully in fixing the upper end of the bone, at the same time determines a line of greatest weakness and least resistance in the bone. In attempting to recover the balance, the long flexor muscles of the thigh are very strongly contracted and a powerful stress is exerted across the length of the femur which has the tendency to bow the femur in a forward direction. A sufficient continuation of the indicated stress and strain results in a solution



of continuity, and the latter must necessarily take place at the line of least resistance, later determined by the Y ligament, which corresponds with the lowermost line of attachment of its fibres a little below the junction of the neck and the shaft of the bone." Though this mechanism may account for isolated tearing off of the lesser trochanter which usually occurs in runners whose backward foot slips and permits forcible hyper-extension of the leg (or of the body if the leg were fixed), it cannot account for a solution of continuity diagonally through the trochanteric bone. It might be responsible for some sub-trochanteric fractures of the femur.

In mechanical analysis, intertrochanteric fracture is a compression fracture, caused by the direct trauma

self by a powerful action of the external rotators or extensors of the thigh; they are in rigid contraction. Suddenly he strikes the ground. The force of his whole momentum is transmitted through the pelvis to the head of the femur and on downward to the ground as he strikes in the region of the upper thigh and trochanter. This supplies a powerful force acting in that direction. As he strikes the ground resistance the thigh held rigidly in some degree of abduction and external rotation by the contracted muscles attached to the greater trochanter is suddenly and most powerfully adducted. The two forces acting in these nearly opposite directions cause the bone to bend; it tends to bend at a point A (See fig. 2) where there is a normal angle in the longitudinal axis,

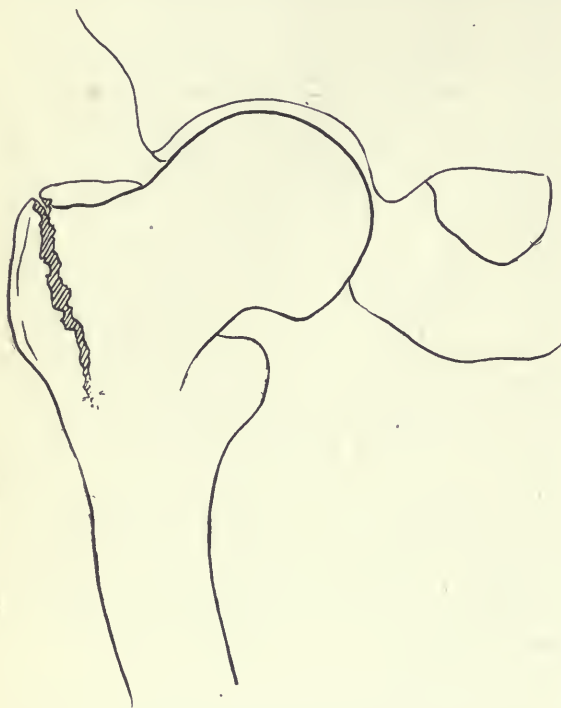


Fig. 3. Incomplete intertrochanteric fracture. The plane of bone separation starts at the summit of the greater trochanter and points down and inward. The angle of the head fragment to the shaft remains unchanged.

of a fall on the hip which sharply adducts the thigh. In compression fracture the plane of bone separation starts on the convex side of a bending compressed bone which may be compared to a beam supporting a force acting at right angles to its longitudinal axis. The individual who suffers this fracture falls off a height, a car, a ladder or even from a standing position as on an icy sidewalk. He must fall laterally or backward, generally the latter. If he fell forward he would sustain a Colles fracture, a dislocated elbow, a fractured humerus or clavicle. But he falls backward heavily. He has possibly tried to save him-



Fig. 4. Example of a slightly more extensive incomplete fracture,—the plane of separation not quite reaching the opposite side of the femur. The angle of the neck might be slightly reduced as it is in this case.

and this point becomes the convex side of the bending beam or bone. Consequently if force sufficient to result in fracture is present, a plane of separation will start at the apex of this bend. That is, the plane of separation of the bone will start at or near the greater trochanter, and pass obliquely, as in most compression fractures, toward the opposite side of the bone, toward the lesser trochanter. This is exactly what is shown by skiagrams of incomplete fractures in this region. (See figs. 3 and 4). If the force is stronger and acts beyond a result that ends in incomplete fracture, we will find complete fracture with the thigh further adducted, the angle of the neck



reduced to 90 degrees, or even less, the tip of the greater trochanteric portion shoved up toward the pelvis and the lesser trochanter squeezed off as a

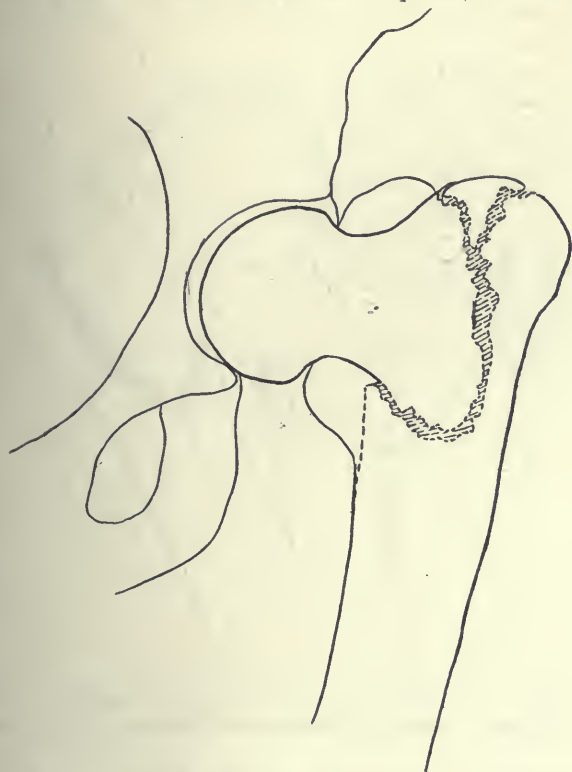


Fig. 5. Complete fracture. The angle of the neck is reduced to less than 90°. Impacted.



Fig. 7. Complete fracture with 3 fragments and wide separation. Note the triangular lesser trochanteric fragment squeezed off. The neck angle is reduced and some shortening of the leg is present although the greater trochanteric summit does not seem much elevated. It is difficult in such a case to decide whether the trochanter rises above Nelaton's line or not.

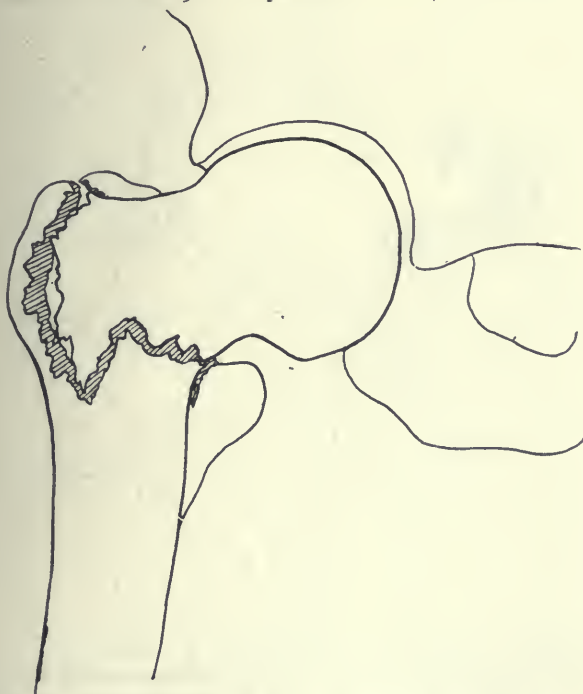


Fig. 6. Complete fracture with slightly different plane of separation assuming a right angle. The tip of the greater trochanter is separated and the neck angle is reduced.

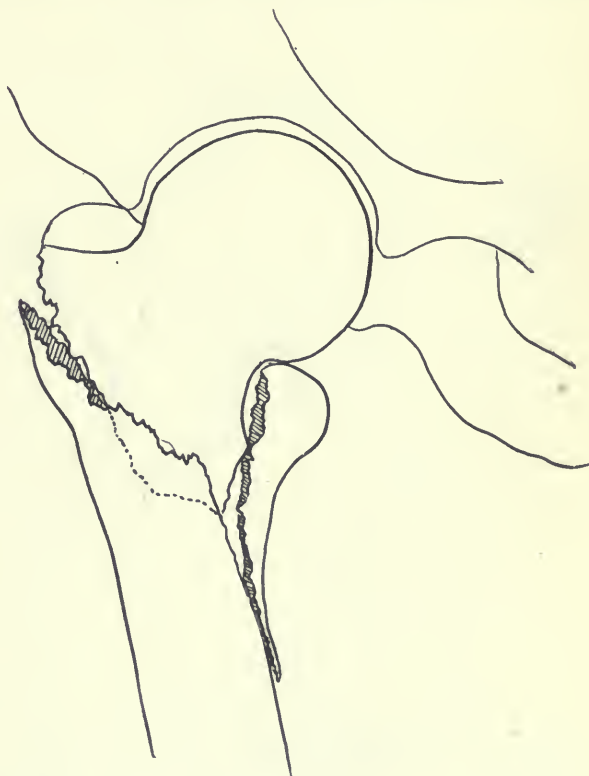


Fig. 8. Complete fracture with 3 fragments, impaction of neck into shaft, and change of neck angle.

triangular fragment, as in ordinary compression fracture. (See figs. 5, 6, 7, and 8). The greater the vio-



lence, that is, the greater the body weight, momentum, or height from which the fall occurs, the more com-

diverging planes of fracture manifest themselves. We would expect, if this mechanism is the real ex-



Fig. 9 Complete intertrochanteric fracture with no impaction and little disturbance of neck angle. This is the result of reduction on a fracture table.



Fig. 11. Complete fracture with slight impaction. Note the plane of separation starting down the shaft of the femur.



Fig. 10. Complete fracture with changed neck angle. No impaction. An unusual finding.



Fig. 12. Complete fracture with a transverse line through the greater trochanter. Note the impaction of the neck fragment into the shaft.

plete the fracture and the greater the possibility of comminution into 3 to 5 fragments as different

planation of intertrochanteric fracture, to find that there is more or less impaction of the two fragments. This is almost always present in complete inter-



trochanteric fracture; the neck or acetabular fragment is driven into the cancellous tissue of the upper shaft. (See figs. 9-19, inclusive.)

When a patient falls on the greater trochanter with

Compression mechanism described thus explains the following points in intertrochanteric fracture:

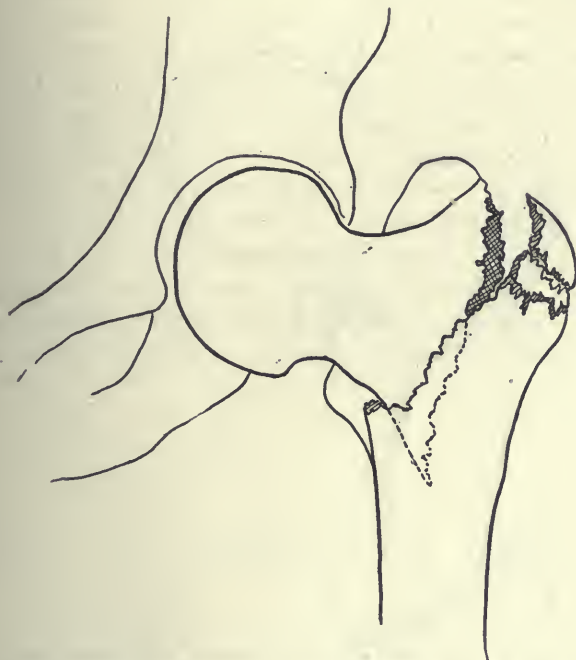


Fig. 13. Complete fracture with impaction. Note the reduced neck angle.



Fig. 15. Complete fracture with impaction with the shaft fragment elevated to cause more than average shortening of the leg for this type of injury.



Fig. 14. Complete fracture with impaction below and separation above at the summit of the greater trochanter, furnishing a neck angle of  $90^{\circ}$ . This is the usual fracture.



Fig. 16. An impacted fracture in an adult man.

leg unabducted and external rotators not contracted, we would expect to find as a result fracture of the femoral head or neck or occasionally central dislocation of the head of the femur.

(a) Impaction of the upper or neck fragment into the lower fragment which is shown quite constantly in this study of 120 cases.



(b) Reduction of the angle of the neck to 90 degrees, the usual finding.

(c) Planes of fracture *always* starting at the greater trochanter and passing obliquely down and inward.

found extending down into the shaft of the femur.



Fig. 17. Complete fracture. The shaft rides upward.

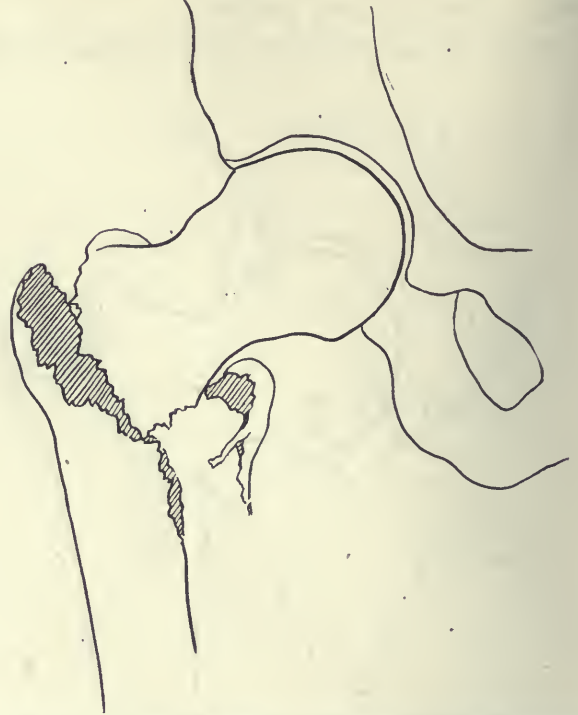


Fig. 19. Complete impacted fracture with wider separation of the lesser trochanter.

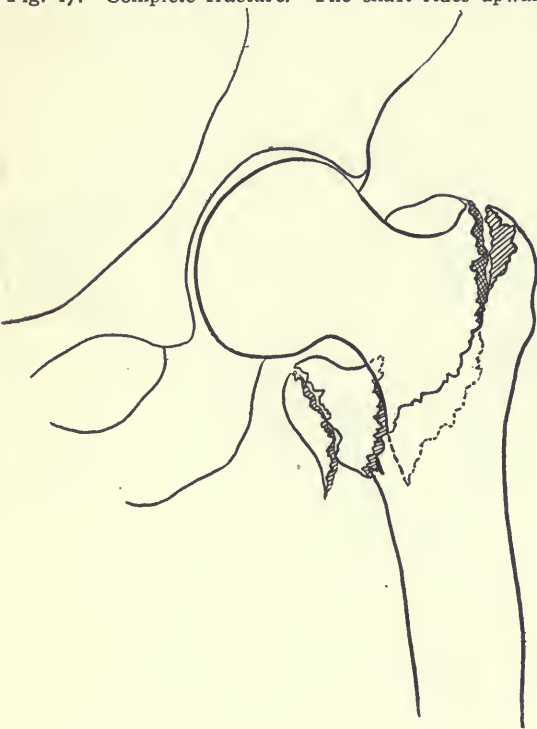


Fig. 18. Complete fracture, impacted, with some separation of the lesser trochanter.

(d) Comminution into 4 or 5 fragments sometimes found.

(e) Additional planes of fracture sometimes



Fig. 20. Extreme elevation of the shaft fragment after intertrochanteric fracture. This would give a maximum shortening of the leg.

(f) Certain visceral symptoms showing injury of the bladder, kidney and intestine.



Because the average age of persons sustaining these fractures is over 62 years, we would expect some age and disuse atrophy of the cancellous bone in the intertrochanteric area which possibly would favor fracture. Those cases of intertrochanteric fracture arising in youth or young adult life are always accompanied by intense violence, because in the average young adult the extra strong bone of the intertrochanteric region is powerful enough to sustain average falls without suffering a solution of continuity.

*Signs and Symptoms:* The adult patient cannot usually walk after sustaining this fracture. He must be carried away from the scene of accident. Younger individuals suffering intertrochanteric fracture with or without impaction or with incomplete fracture

trochanter may be felt to move in rotation with the shaft. This may be painful.

The relation of the upper border of the greater trochanter to the Roser-Nelaton line may be unchanged. It was slightly elevated in 40% of our cases. (Figs. 20 and 21).

Attempts to abduct or externally rotate the injured leg were particularly painful. This finding is almost always present. Visceral symptoms may be present. Two patients of this series presented hematuria, in one case lasting 30, in the other 24 hours. One patient had a large bloody stool twice following the accident. One had symptoms of intestinal obstruction. These symptoms add confirmation of the

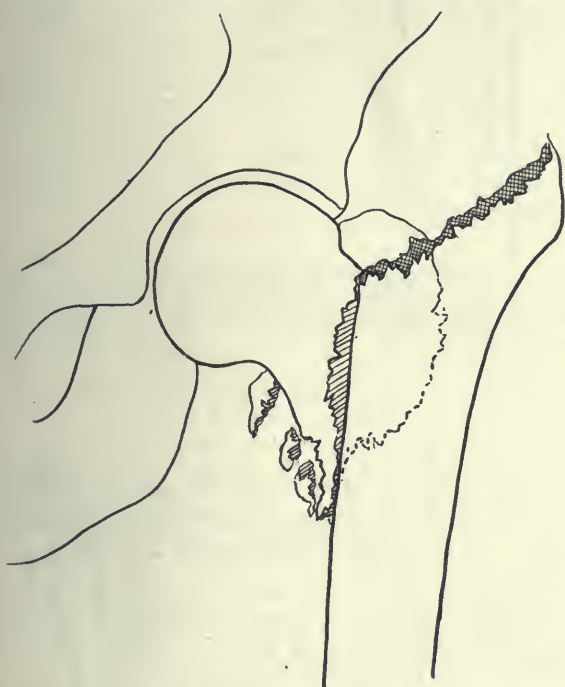


Fig. 21. Another instance of great shortening. The indication to extend and then abduct the shaft of the femur in treatment is plainly indicated.

frequently walk after a fracture of this type for several days before its true nature is recognized. This is in contradistinction to the average fracture of the neck of the femur. Therefore immediate loss of function is variable. Shortening may or may not be present—usually is very slight even to expert measurement. Swelling and fullness with late appearing ecchymoses about the hip region occur in the severe complete intertrochanteric fracture. The axis of the limb may be little changed. The foot does not tend as a rule to lie inert and helpless on its outer aspect. Crepitus may be easily perceived on slight motion of the hip when there is complete fracture with separation. Impacted fracture gives no crepitus and the



Fig. 22. Reduction obtained in the usual fracture of 2 fragments. Note the restoration of the neck angle and the length acquired with the abducted position of the thigh.

traumatic cause of the fracture. The bone pathology in every case in this series was confirmed by roentgenogram.

*Treatment:* Incomplete intertrochanteric fracture calls for rest in bed for a couple of weeks. No weight should be borne for three to four weeks. Hot applications on the hip relieve pain and swelling.

Complete fractures, which show a change in the angle of the neck of the femur, require proper immobilization. The indications to be met in the treatment are:

- Slight shortening—
- Adduction of the leg—
- Reduction in the angle of the neck.



Because the plane of this fracture has passed through cancellous bone, we can anticipate a bony union in practically every case, even following a

it is under tension abduct it to the maximum, turn the foot slightly inward and place the patient in a body cast, such as is used for fracture of the neck of



Fig. 23. Reduction of a comminuted intertrochanteric fracture. The loosened trochanters fail to follow the shaft. A position half flexion of the thigh combined with abduction aids reduction of this separation.



Fig. 25. Complete fracture healed in malposition. Abduction alone would have promised a fair reduction of this fracture. Note the abundant callus. The permanent neck angle here is about  $90^{\circ}$ .

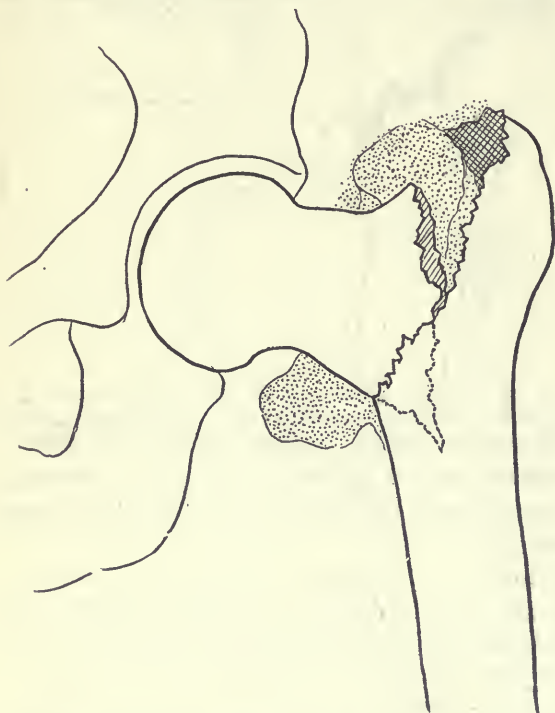


Fig. 24. Complete impacted fracture healing in an unreduced position. Callus rapidly filling in. Extension and abduction required to restore length and neck angle. This case resulted in  $1\frac{1}{4}$  inches shortening and limited hip motion.

short rest in bed with little immobilization. Our series verifies this fact. To satisfy the indications given, we should extend the leg by traction and while



Fig. 26. Complete fracture healed in malposition. Note the huge callus and neck angle less than  $90^{\circ}$ . This type of union leads to a maximum shortening and loss of function of the hip joint.

the femur. This cast need be worn but six to eight weeks. The patient can then become ambulatory, wearing a walking caliper for six weeks to take



weight off the young callus, moving his hip while not bearing weight. (Figs. 22 and 23).

Old individuals who for any reason cannot tolerate a plaster of Paris cast, may lie in bed propped on pillows or possibly submit to a Buck extension for a few weeks. There is practically never indication for open operation on an intertrochanteric fracture of the femur.

*Results:* The mortality under all treatments is as given. The average result is a bony union. If extension and abduction have restored the fragments to proper position, we can expect no shortening. There is usually some restriction of hip motion, no matter how perfect the reduction of fragments. When proper reduction and immobilization has not been followed, we may expect shortening up to one inch, seldom more, considerable excess callus which leads to restriction in hip joint function, and some adduction of the leg on account of the change of neck angle. Bony union, however, permits weight bearing and a fair function to these old people. (See figs. 24, 25, 26). Incomplete fractures give excellent results after six weeks.

*Note*—Each illustration of fracture is made from the tracing of the roentgenogram of an actual case, selected by the author.

122 SOUTH MICHIGAN AVENUE.

After all, the localization of bone tenderness is not only the most useful sign in determining the site of a fracture, but, even in the absence of other signs, it is often, in itself, diagnostic of the presence of a fracture. As instances may be cited greenstick fracture of the clavicle, and fracture of the metacarpal and metatarsal bones.

#### CANCER RESEARCH

Cancer research will be taught at Columbia University during the Summer Session. The course will be given at the Crocker Laboratory, 1145 Amsterdam Avenue, and will deal with the morphology and biology of tumors, under the direction of Prof. W. H. Woglom of the laboratory staff.

The instruction will consist of a series of lectures and laboratory exercises, and is intended to give the student sufficient experience to enable him to diagnose all the commoner varieties of tumors. It is planned especially for the needs of those who are to take up hospital or public health laboratory positions which may require the microscopic diagnosis of tumors.

## STANDARDIZED TREATMENT OF FRACTURES OF THE LEG.\*

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For descriptive purposes and in accordance with clinical findings we may regionally divide fracture of the leg into three zones of incidence: an upper, middle and lower.

The *upper third* zone includes fractures of the tibial and fibular head, the tibial tubercle and the adjacent portion of the upper end of the tibia and fibula, not excepting the very rare fracture of a tibial spine.

The *middle third* includes the central portion of the shaft of both bones.

The *lower third* comprises both malleoli and the shaft portion immediately contiguous.

In a broader classification we may regard the leg as being the site of fracture in its articular and in its shaft portions. More broadly yet, we can say that from a clinical standpoint we encounter fracture of the leg below the centre of the shaft in approximately 80% of cases, this including the average shaft fracture and the very frequent fractures about the ankle.

For the purposes of this article, reference will be made only to typical examples of fracture in the zones already indicated.

There are certain considerations in fracture of the leg that have a special bearing as to diagnosis, prognosis and standardized treatment, and of these I would mention:—

(1) The frequency of non-union in fracture of the lower third of the tibia. In my experience there are more cases of non-union in this location than of all other fractures combined.

(2) The almost total absence of non-union in fracture of the fibula, even in the presence of marked over-riding or gross deformity. I do not recall having seen a case of non-union in this bone. The fibula has an unusually large nutrient artery.

(3) The rarity of non-union when the articular ends are involved (detached marginal fractures excepted). Clinically we observe that articular fractures in all locations usually end in bony union except fractures of the neck of the femur.

(4) Compound fracture of the leg is more prone to infection than any other compound fracture,

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mainly because the tibia is sub-cutaneous, with stasis of circulation acting as a contributing factor.

(5) Blebs are more frequent in leg fractures than elsewhere and they are often massive and numerous.

(6) The position of the external popliteal (peroneal) nerve winding around the head of the fibula makes this a danger zone because pressure from splints or apparatus invites foot-drop.

(7) The frequency with which a long oblique fracture of the lower third of the tibia is associated with fracture of the upper end of the fibula; this fracture is due to torsional violence, and when separation of the tibial fragments is marked, there is a great tendency toward muscular impingement leading to non-union.

(8) Many cases of ankle injury with gross eversion and posterior deformity are still looked upon as dislocations despite the fact that Sir Percival Pott disproved this possibility nearly 125 years ago.

Irrespective of the cause, site or variety of a fracture of the leg, we recognize that in reality there are but two clinical types, either of which may be simple or compound:

*Type I* is the *displaced variety* in which the fragments are markedly separated.

*Type II* is the *non-displaced variety* in which the fragments are slightly separated.

This "typing" applies also to fractures of any other part of the skeleton and is of importance because in Type I the essentials of treatment are reduction and retention; but in Type II, only retention is necessary.

It is important to remember also that the bone injury is only one part of the pathology of any fracture and that the associated lesions may prove equally important because they affect the soft parts (myotenosynovitis), the articulations (synovitis, bursitis, arthritis) and the vessels (vascular and neural).

#### DIAGNOSIS.

The Type I cases present no difficulty. They are apparent to the sense of sight as deformations and the only differentiation is as between articular fracture and dislocation. In this connection it is helpful to remember that about 80% of so-called dislocations of the knee and ankle prove on later examination to be fractures. In Type II differentiation is as between non-displaced fracture and contusion-sprain; and this becomes apparent to the sense of touch which determines the presence or absence of local pain. If the latter can be demonstrated by direct or indirect pressure, a diagnosis of fracture is warranted.

#### TREATMENT.

An attempt is made to standardize and make uniform our procedure and with that in view, the respective non-compounded types are treated as follows:

Type II—all zones. Two-piece antero-postero moulded plaster of Paris cast reaching from the toes to 6 inches above the knee. If the fracture is at or below base of malleolus, the splint does not include the knee. If the fibula alone is broken,

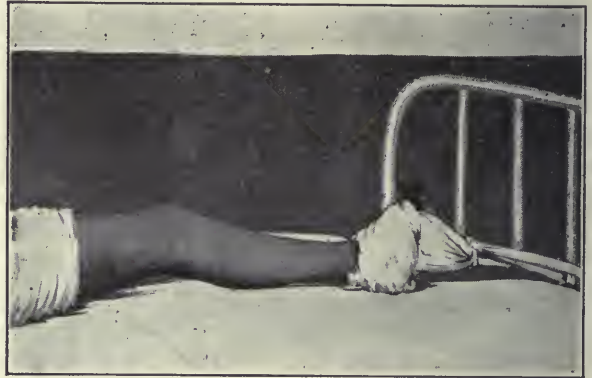


Fig. 1. Temporary traction by towel or sheet.

only the posterior half of the cast is used—the so-called "slipper splint".

Type I—all zones. If reduction can be made effectual by immediate or prolonged traction (i. e., by weights, straps or on a fracture table) then the case has been converted into Type II and treatment is as above indicated. If, however, reduction cannot be effected by manual traction,

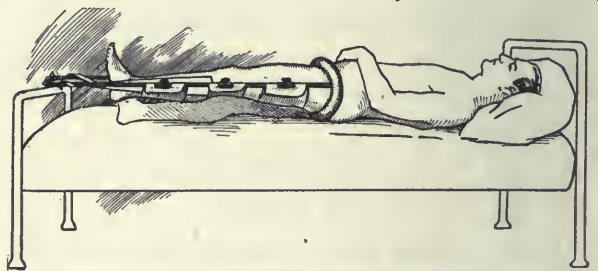


Fig. 2. Thomas splint with adhesive plaster traction straps.

by sheet or towel traction or by straps with or without a Thomas splint (fig. 1.) and the overhead (so-called Balkan) frame (fig. 3), then the case falls into the group I denote as the "irreducibles" and some form of operation becomes necessary. Hitherto the procedure has been open reduction by operative exposure of the fracture site, but in my experience this has not been necessary since resorting to "skeletal traction" as effected by the use of the Finochietto stirrup, (fig. 4.) the tongs (calipers),



or transfixion by the nail. Of these my preference is for the stirrup passed over the os calcis (figs. 4 and 5), or the tongs thrust into the malleoli (fig. 6).

The use of non-absorbent material (plates, wires, screws) is deservedly falling into disuse and my be-

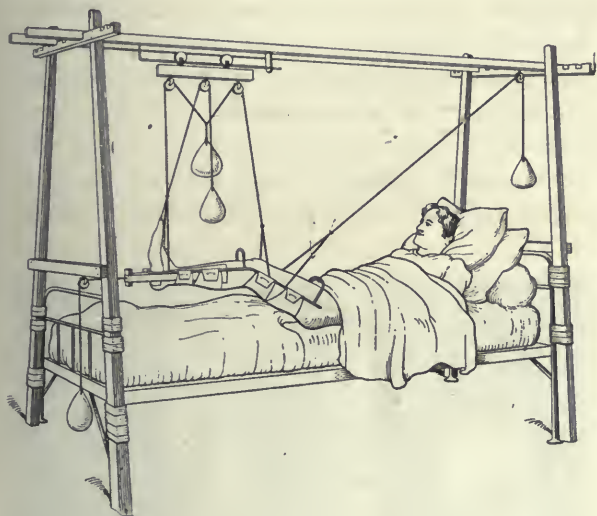


Fig. 3 Fracture of the leg. Hodgen splint and overhead suspension frame, Blake type, adhesive plaster or glued flannel traction straps along leg. Note the glued sock attached to cord and weight to prevent foot-drop. Knee is flexed at an angle of about 135 degrees.

lief is that in another five years plates will be as rarely used as wooden handled instruments.

Compound fractures are treated, after tetanus



Fig. 4. Finochietto stirrup and method of obtaining traction by passing it over the os calcis.

antitoxin injection, according to their severity, as follows:

*Mild*—with punctured wound. Iodine disinfection through a syringe. Iodine-saline wet dressing, (iodine one dram, saline solution 1 pint).

*Moderate*—with lacerated wound. Iodine sterilization, débridement, partial suture or delayed suture, Iodine-saline dressing.

*Severe*—with crushing wound. As above. Delayed suture preferable in 3-6 days.

If, however, *immediate* reduction is impossible by the preceding means, then *intermediate* reduction is to be employed by means of weights attached to the limb by adhesive plaster or glued strips of flannel. The knee is flexed ( $15^{\circ}$ — $30^{\circ}$ ), the foot of the bed is



Fig. 5. Supra malleolar fracture of the tibia and fibula. Reduction satisfactory. Finochietto stirrup in situ.

elevated and the limb is placed in a Thomas or Hodgen splint, or some form of inclined plane, and slung to an overhead frame of the so-called "Balkan" type. Massage and motion are given from the outset. This apparatus is employed until union is firm and then an antero-postero moulded plaster of Paris splint is substituted, this reaching from the toes to above the knee. The front half of this is removed frequently for massage and motion. Another plan is to apply a "walking calipers" (fig. 5) instead of the 2-piece plaster of Paris splint as this permits walking with all the advantages of ambulatory treatment. It will be noted that nothing is said as to a



circular plaster of Paris cast because this type of splint often acts as a tourniquet, it hides the parts, it prevents massage and motion. Hence it is not only dangerous but is also a foe to early return of function. In compound fractures a splint of this encircling type is particularly inferior to the traction methods or to the two-piece splint. In all forms of traction, the direction of pull is that of the *upper*

surface of the tibia and the upper surface of the astragalus. It is important to remember that marked types of that fracture may show displacement of the interosseous malleolus (lower outer end of tibia) in addition to the classical fracture of the fibula and the laceration of the internal lateral and interosseous ligaments. The key to treatment is the restoration of the tibial-astragalus concavo-convexity and unless this see-saw arrangement is restored, the architecture of the joint will be compromised and functionally impaired.

To properly reduce a Pott's fracture, anesthesia is necessary and for this purpose nitrous oxide, ether

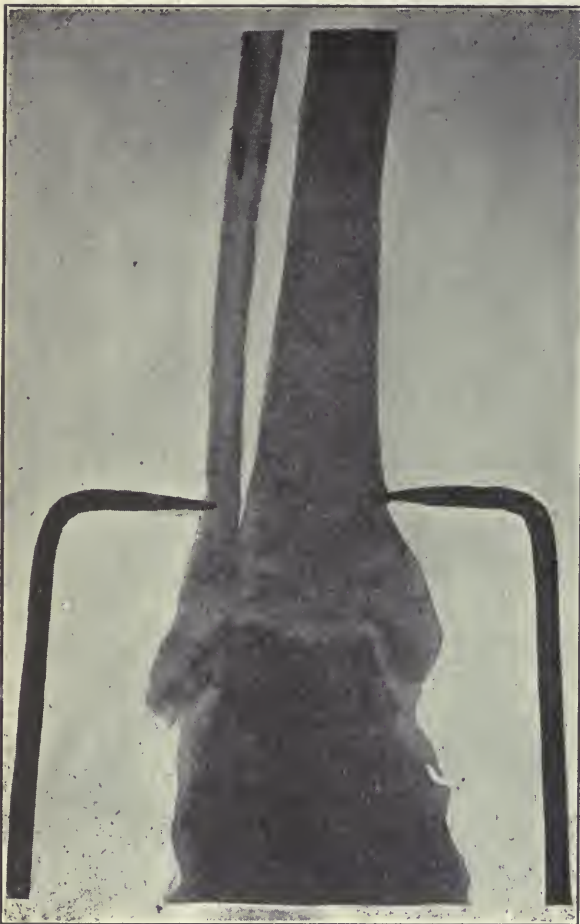


Fig. 6. Tongs applied to malleoli for fracture of leg. Note that depth of penetration in subperiosteal.

fragment and counter-traction is best obtained by elevating the foot of the bed. It is prudent to employ 10-20 pound traction weights at first so that muscle spasm may be early overcome; once this is accomplished, a weight of 5 pounds suffices.

It cannot be too strongly insisted upon that we *set* a fracture not by *setting* the bone, but by *setting* the muscles which maintain bony mal-alignment.

In *Pott's fracture* there exists, practically, a fracture-dislocation, inasmuch as the entire foot is displaced outward and backward because of the upset of the concavo-convex junction between the under



Fig. 7. The "walking calipers" for ambulatory treatment and for use after union is reasonably firm. This is essentially a Thomas splint with the lower end fitted into the heel.

(by the drop method) and ethyl chlorid (on the mask) are the safest in the order named. Chloroform is particularly dangerous in fractures and dislocations; indeed this agent is as dangerous in traumatic surgery as it is safe in obstetric surgery. Relaxation of the tendo Achillis is the next essential and hence folding the thigh fully on the abdomen is the proper posture before reduction is attempted. Next the foot should be firmly grasped and the deformity *markedly increased* up to the point of obtaining very free false motion and crepitus. Then slow and gradual downward traction is made until a sensation of "giving" is felt. Next the foot is brought as far forward (flexion) and inward (inversion) as possible. If the correction is satisfactory, (1) the



bony deformity disappears; (2) the malleoli are on the proper level; (3) pressure of one finger against the sole holds the foot at a right angle (Jones' test). A loop of a bandage is then placed around the big toe and the free end of this is given to an assistant until the patient is out of anesthesia or the splint is in place. A two-piece moulded plaster of Paris splint is now applied—the Stimson splint. The posterior portion of this 4-inch wide strip passes from the web of the toes, along the sole, over the heel and up the back of the leg to the lower part of the popliteal space. The lateral 4-inch piece begins over the inner malleolus, crosses the instep, passes under the sole (surmounting the posterior part of the splint) and goes up the inner side of the leg as high as the other part of the splint. A bandage holds both sections of this postero-lateral plaster mould, and the anterior half is removed daily or less often for massage. The outer portion of the leg is thus free for inspection and circulation.

Passive motion of the ankle begins within the first week, active motion about the tenth day, the ankle being held during the early phases of this part of treatment. In no fracture is *early mobilization* so important, otherwise organized exudate from associated synovitis, arthritis and myotenosynovitis will produce stiffness despite accurate bony readjustment. The lateral half of the splint can be removed as soon as union is relatively firm and when active ankle motion causes no reaction. This is ordinarily at the end of a fortnight, and thereafter the posterior part of the splint is gradually shortened so that it is all off by the end of the fourth week. Adhesive strapping or a linen-mesh bandage is then substituted and walking on the *flat of the foot* is allowed when pounding on the heel or firm pressure on the sole is painless. The patient is made to toe-in at first so that eversion is prevented; in some cases building up of the inner side of the sole and heel will aid in this element of treatment.

There is another group of fractures of the shaft of the tibia and some supramalleolar fractures in which the preceding immediate or intermediate methods of reduction are unsatisfactory. These are certain compound fractures and others in which the displacement is very irregular, such as the long oblique much displaced type, or particularly fractures of the lower third with much mal-alignment. This group I term the "irreducibles", and formerly operation was the necessity so that coaptation was accomplished by some form of suture, such as kangaroo tendon, wire, screws, bands, plates or other

interposed materials. The use of non-absorbable materials has justly fallen into disfavor because of their danger as to life and limb, their tendency to cause non-union and osteomyelitis. Personally, I have not found it necessary to plate or wire a fracture in a decade, and this form of treatment is not needed if for it is substituted *skeletal traction*. The principle of treatment here is that alignment is obtained by introducing a 3-16 inch nail through the malleoli or os calcis (Steinmann transfixion method); or by placing tongs or calipers on the malleoli or os calcis (Ransohoff tongs or calipers method); or by passing the band of a stirrup over the os calcis in front of the tendo Achillis (Finochietto stirrup method). The traction thus obtained is *direct or internal* as opposed to the *indirect or external* method represented by other forms of traction. Of these forms of skeletal traction, the tongs or stirrup are most useful in leg fractures, and the nail in femur fractures. There is little or no danger of bone infection and the skin infection is negligible. These traction devices can be introduced under local anesthesia and removal to the hospital is not necessary. Reference to the diagrams will sufficiently indicate the procedures, which I have described at length elsewhere. When union is firm, the traction appliance is removed, the two-piece plaster of Paris antero-postero splint is substituted, or the "walking calipers" is employed. Under this form of treatment I feel certain that non-union will be less frequent, deformity will be lessened, joint stiffness minimized.

*Non-union*, if resistant, is best treated by bone grafting, either in the form of the sliding or socketed graft taken from the same leg, or a graft from the opposite leg. If there is no great displacement, a periosteal-cortical graft will often supply the necessary bony transfusion as effectively as a periosteal-cortical-medullary graft, plus the additional advantage of an operation easier for the patient and the surgeon.

*Mal-union* demands open osteotomy (refracture), the removal of osseous spurs and the application of skeletal traction; some early cases will respond to closed osteotomy and skeletal traction.

The radiograph of the elbow of a child shows shadows of numerous epiphyses. One inexperienced with x-ray plates is very apt to mistake one or more of these for fractures. When examining the skiagraph of a child's elbow suspected of fracture or dislocation, it is, therefore, important to have the normal picture in mind, or better yet in hand, for comparison.



## TREATMENT OF ANKLE FRACTURES.

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BOSTON.

Ankle fractures are common, do not do uniformly well, offer a considerable variety of complications, and are therefore interesting, in spite of the fact that the problems involved are intrinsically rather simple.

The diagnosis is *made* by eye and hand, *confirmed* by the x-ray examination. *Reversing* this order in diagnosis is the reason of most of the calamities that are not very uncommon even today.

There are five main types. Each type has its own definite reduction maneuver.

To treat these cases one *must know the types* and must be mechanical-minded, and not without some skill of hand.

The types are:

1. Fibula fracture.
2. Pott's fracture.
3. Inversion Pott's fracture.
4. "Cotton's fracture".
5. Fracture of both bones above the ankle.

Breaks of both bones, slanting down into the joint, and separations of the epiphysis of the tibia are, mechanically considered, but variants of type 5.

TYPE I, fibula fracture, is the result usually of an inward twist, a "turning" of the ankle. Such a twist, if slight, produces a "sprain". In a sprain the tendons are stretched, and the ligaments between tibia and fibula are torn a bit, often torn away from bone enough to show later in the roentgenogram by a bit of new growth of bone. A bit more twist is too much for the fibula and it cracks, usually above the joint, usually on a slant up and back.

If there is, in addition to the signs of sprain, definite tenderness across the surface where the fibula is subcutaneous, one may be pretty sure the bone is broken. If, with this condition, there is no clear sign of damage about the inner ankle, no displacement possible, in, or out, or back, on reasonable forced pressure, one may be pretty sure nothing else is gone.

With fracture of the fibula alone, one merely shoves forward on the lower fragment to get the best contact possible (and it really matters not at all if this is not very exact) and then puts the foot up in plaster for three or four weeks, then protects with adhesive strapping.

It is but a trivial injury.

TYPE II. If one adds to the above picture ecchymosis and swelling and tenderness on the *inner* side,

and either an outward displacement of the foot, or a condition in which the foot is readily displaced *outward*, then one has to deal with a *Pott's fracture*.

The injury at the inner side is a breaking off of the malleolus or a tearing away of ligaments;—in either case the lesion is serious,—serious because it is essentially an *outward luxation* of the foot. (See fig. I, A).

*Prompt* reduction of the luxation is essential.

Primarily compound fracture is not common, but it is not very uncommon, in neglected cases, for the skin over the sharp edge on the inner side to slough, with disastrous results.

Reduce, therefore, and hold the reduction even if

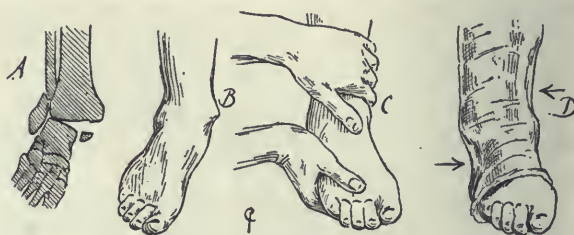


Fig. 1. Type 2. Pott's fracture.

- A. Bone lesion: Fracture of fibula. Either fracture of malleolar tip (as shown) or a tearing of ligaments only, on the inner side, below the malleolus.
- B. External deformity, *outward luxation* of the foot as a whole. Usually a spur-like projection at B.—the lower spade-like edge of the intact tibial shaft from which the broken piece has been torn away and displaced outward.
- C. Reduction. Pull *outward* above the ankle, push the foot *inward*. *Over-correction is impossible*.
- D. Retention: Loose plaster of Paris bandage over padding. Before setting of the plaster, go through reduction motions again, pulling out above the ankle, shoving the foot inward, as the arrows show, and hold pressure in and out at these points until the bandage has "set". Keep the foot at right angles.

a second setting is needed after checking up with the x-rays.

Reduction is easy and is accomplished by swinging the foot *inward* until it is corrected. One *can not over-correct*; if the foot can be over-corrected the diagnosis is wrong!

It is right enough to carry the foot inward, into supination a little, to maintain full correction; extreme inversion, as carried out in the old "long Dupuytren" splint, is painful and needless.

Union always occurs, I think, and the two cases of ununited internal malleolar tip, the one case of overlong internal malleolus that I have seen, were obviously the result of lack of protection in early convalescence.

The danger in this particular lesion is of flat-foot, of which more later.



TYPE III reverses the lesion and the displacement. The lesion is called inverted Pott's, inversion Pott's, or reversed Pott's fracture. The fibula is broken *not above, but at the joint*, the internal malleolus not near its tip but from the joint-angle *up and in*, often with separation of a considerable piece of bone.

The x-ray picture looks a good deal like that of a true "Pott's" fracture—in a general way.

It should be pounded into the head of every interne that a fracture of both malleoli *may or may not* be a Pott's fracture. I have repeatedly seen in my own hospital lamentable messes due to the error of confounding Pott's and inverted Pott's fractures.

The story is not one of the bone lesion as such.

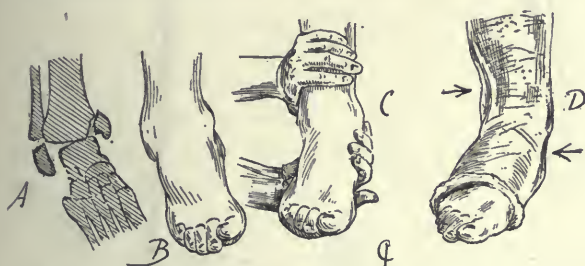


Fig. 2. Type 3. Inverted Pott's fracture.

- A. Bone lesion. External malleolus torn away, internal malleolus split up and carried *up and in*. Inward dislocation.
- B. Deformity. Inward dislocation.
- C. Reduction. Inward push above ankle, outward pull on foot. *Over-reduction impossible*.
- D. Retention in plaster of Paris. Repetition of reduction with retention of shove and pull, as the arrows show, until the plaster has set. Keep the foot at a right angle.

The important thing is that an inverted Pott's fracture is an *inward dislocation*, reducible by abduction, made worse—and very bad—by the very reduction properly applied to type 2.

Diagnosis is easy. In type 3 the foot can *easily* be carried *inward* into *obviously abnormal inversion*.

The reduction is *outward*;—here again one *can not over-reduce*; the position to be maintained is moderate *pronation*.

The danger in this type is not the development of flat-foot, but non-union of the inner fragment—a not very rare calamity, enjoining on us an extra period of protection in this type of cases.

TYPE IV is the *backward* luxation, associated with fracture of both malleoli and a *splitting off of the back edge of the tibia*. Recognized before, of course, these cases seem to have been grouped as a type for the first time only a half-dozen years ago.\*

Backward displacement without this break in the back edge, is distinctly rare.

The lesion now under consideration is so common that in my first report classifying this fracture\* I was able to cite 53 cases of my own,—and I have been seeing them ever since.

The diagnosis of this "Cotton's fracture" is easy enough. Usually obvious to a trained eye, the backward displacement may be verified more exactly by the projection of the lower edge of the tibia in front above the ankle joint. (see fig. 3, B).

If the displacement has already been reduced, the condition is obvious from the ease with which the foot drops back into dislocation on handling it.

Here again one reduces "the way it came out" but not always as readily as with types 1 and 2.

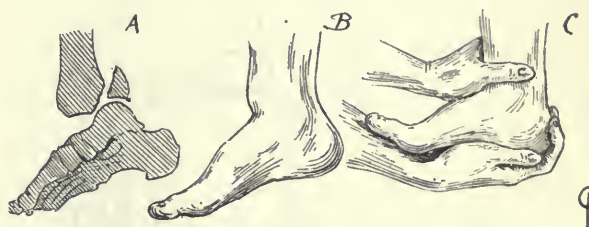


Fig. 3. Type 4. "Cotton's" fracture.

- A. Bone lesion. A piece split away from the back edge of the tibia. Also fracture of both malleoli. (Some times back-edge of tibia and internal malleolus go in one piece). Primarily a backward luxation with fractures.
- B. Deformity. A *backward displacement of the foot*. There is usually a sharp prominence of the lower front edge of the tibia in front, above the displaced foot—if one feels for it!
- C. Reduction. Backward pressure on front above ankle, then a forward pull, downward at first, then up and into dorsal flexion—to lock.
- Retention calls only for maintenance of dorsal flexion in plaster.

Let the foot drop into plantar flexion, then *drag it down and forward* into place, and bring it up into *forced dorsal flexion*. In this position it *locks* solidly in place, and there is little difficulty in holding correction in plaster.

TYPE V is in fact no type. It is like the "type 4" of pneumonia,—anything that isn't the other things—and no real rules can be given.

Here, not as with the other four types, one needs the x-ray finding before doing anything real in treatment or even in diagnosis. If we have a cross-break or an epiphyseal separation we need only reduce and put up in the neutral position.

This same procedure may suffice with breaks slanting into the joint, or we may have to hold them with special pads, or with special pressure outside the plaster, or may at times have to resort to open operation.

If there is comminution, simple plaster may serve,

\*Cotton: *Journal Am. Med. Ass'n*, January 23, 1915, LXIV, p. 318.



or we may need traction in splints (the old "short Dupuytren", with traction two ways, is not bad) or traction in combination with plaster, or (rarely) open operation may be resorted to. There are no rules that will cover. Fortunately, these cases are apt to do well if decently replaced with a proper eye to *weight-bearing lines*, and the delayed union common in the fractures between middle and lower thirds is not common close to the joint.

#### ITEMS IN TREATMENT.

1. *X-ray examination.* Always to be made, but in types 1-4 it may be wise to reduce first, and



Fig. 4. Boston City Hospital "Pillow and Side Splints." To be genuine, one should use tied bandages. Buckle straps, rather more efficient, seem to offend precedent.

*always* one should reduce promptly, roentgenogram or no roentgenogram, if there is great displacement, even if this does not threaten sloughing.

Delay means too much suffering and probably too much tissue reaction.

2. When is *immediate plaster of Paris dressing* advisable? Usually in type 1; and in the other types if there is little reaction. If in doubt use the old Boston City Hospital dressing of "pillow and side splints", shown in Fig. 4. It is comfortable and may be made to hold any of these fractures adequately for a time. But *do not put unreduced luxation-*

*fractures up in this way* or in any way until they are brought into at least *decent* position.

3. *Blebs.* These often appear in ankle fractures. They are to be treated by alcohol sterilization of the surfaces then alcohol dressing (1 part to 3) and they are to be opened when full. The alcohol dressing, continued, carries them by the chance of sepsis, and



Fig. 5. Outside upright. Steel half circle at top, completed with leather strap. Ankle joint. Inside "T" strap fastened to shoe at inner edge of shank, just at front end of the heel, buckling around the upright on the outer side, just above the ankle.

presently a dry dressing with zinc stearate powder makes possible the handling needful for a real reduction, with subsequent plaster of Paris splinting.

4. *Splints.* Uniformly inferior to plaster of Paris save for certain cases of type 5. If a splint is to be used I always prefer the Cabot "posterior wire" splint with flat side splints as needed. This gives easy access for inspection and change of pads or for dressings.



5. *Technique of plaster application.* The best way is to reduce first, then wrap the leg in a moderate covering of sheet wadding, then put on the plaster bandages, not tightly, but *rolled on*.\*

One tries to maintain reduction throughout, but the important thing is that *after the plaster is on* before it sets, one carries out again the reduction found effective in this case, and then keeps up pressure with the hands in the proper places so as to *maintain* reduction. (note arrows in figs. 1, 2, 3).

6. As above noted, *over-correction* of the deformity is impossible in cases types 2, 3, and 4.

7. *Right-angled dorsal flexion* is always to be maintained if possible.

8. *Time of leaving plaster on:*

3 weeks for type 1.

4-5 weeks for type 2.

4-6 weeks for types 3 and 4.

and in type 3 even longer if needed for consolidation of the inner fragment.

9. *After-care and apparatus.*

In type 1 adhesive strapping as for a sprain (Cottrell-Gibney technique) up to the sixth week. Weight-bearing after four weeks. Special caution not needed in average patient.

In type 2, plaster split at 3-4 weeks; massage and motion begun then. Plaster off at 4-5 weeks, and foot then put into a shoe with outside upright, ankle joint and T-strap (see fig. 5). Full weight may be borne after six weeks, and exercises as for flat-foot begun then.

The apparatus may wisely be worn up to four months. If exercises are well done, plates are rarely needed after this but a quarter-inch raise on the inner edge of the heel may often be wise for a while after discarding the brace.

In types 3 and 4 I am apt to use the *double* upright on the shoe, with the ankle joint stopped at first with a pin (which can be knocked out later) and which for the time holds the foot at a right angle. Weight-bearing and exercises are the same as for type 2. Bear in mind, however, that one must go slow with type 3 until certain of union.

Late cases come to us, unfortunately, badly crippled. Those of type 2 may have only flat-foot amenable to treatment for that.

If they have actual displacement there is nothing for it but the bi-malleolar osteotomy described by Stimson. Most important to remember in these operations is that we must not only cut the malleoli but must cut or tear much ligament to get real re-

duction. Properly reduced, and well held in plaster after reduction, these operative cases do well.

Old cases of type 3 also call for osteotomy of the external malleolus. To the inner side one more often needs to refresh surfaces of the ununited fracture. I have found it wise to pin this fragment in place with a steel pin that stays in three weeks. Results have usually been good.

In type 4 one may do bi-malleolar osteotomy and forcibly lever\* the foot into place onto the remaining portion of the tibial articular surface.

Reproduction of the old fracture is not practicable.

If there is too little joint surface left, with a joint stable enough, but crippled because of fixed plantar flexion, this may be dealt with by cutting the front part of the tibia away—liberally.

Results of both operations are much better than one would think, considering the complicated lesion.

In conclusion, may one say that all that is not old in this brief summary is a somewhat sharper division into types; recognition that each of three of the types is essentially a luxation with fractures as complication only; sharper definition of the reduction maneuvers for each type; insistence on early function; insistence on a protection by apparatus not usually used, both to ensure this early function, and to safeguard against the late complications that not uncommonly spoil even those cases of ankle fracture that have been reduced properly at the start.

\*I use a heavy smooth automobile tire-iron, of the old-fashioned type—about 18 inches long.

#### FRACTURE OF THE HEAD OF THE RADIUS.

Fractures of the head of the radius are frequent and are often unrecognized.

The two most common types are a split extending downward into the neck and shaft of the bone and a crushing of the anterior lip.

The cause is not definitely determined.

The diagnosis can usually be made by the muscular spasm which accompanies rotation and this is present in all cases.—L. E. DOUGHERTY in *Minnesota Medicine*

Fractures of the head of the radius are probably more common than generally supposed, being overlooked frequently because of the absence of the ordinary signs of fracture.

Permanent contracture of the muscles, notably of the flexor group in the forearm, may develop within a very short time after the application of a splint that exercises undue compression. It is a wise rule to inspect all fracture dressings within twenty-four hours; and when this is not expedient special care should be exercised, when applying the dressing, to avoid compression.

\*Stimson strip plasters are excellent in many cases but are distinctly not for the novice in plaster work. Personally, I have found the Stimson method of no special use save as furnishing a lighter support, effective enough for the simple fibula fractures.



## POTT'S FRACTURE OF THE FIBULA, OR FRACTURE-DISLOCATION AT THE ANKLE.

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The term "Pott's fracture of the fibula" is and has been so loosely applied to fractures about the ankle joint, that it is quite impossible to know in any given case what the actual injury was, without a careful description of the lesions.

The following is the description given by Percival Pott, of the series of injuries which make up the complex that goes by his name:\*

"This is the case when by leaping or jumping, the fibula breaks in the weak part already mentioned; that is, within two or three inches of its lower extremity. When this happens, the inferior fractured end of the fibula falls inward towards the tibia, having lost its proper support, and not being itself capable of steadily preserving its true perpendicular bearing, is forced off from the astragalus inwards, by which means the weak bursal or common ligament of the joint is violently stretched, if not torn, and the strong ones which fasten the tibia to the astragalus and os calcis are always lacerated, thus producing at the same time a perfect fracture and a partial dislocation to which is sometimes added a wound in the integuments made by the bone at the inner ankle."

This paper is intended to treat of the injury thus described by Pott, which I should prefer to call a dislocation of the ankle joint with fracture of the lower third of the fibula. As a matter of fact, the internal malleolus is not infrequently broken off, sometimes but not frequently by any means, a small part of the external rim of the articular surface of the tibia is also fractured.

The essential features to remember and to recognize in the treatment are: 1. The dislocation of the tibio-astragaloid articulation. 2. The fracture in the lower third of the fibula.

In order clearly to understand this injury, one must have in mind the configuration of the lower ends of the leg bones and the astragalus and os calcis—in other words the make-up of the ankle joint and its immediate connections.

A reference to the diagram, fig. 1, will assist in understanding the points I wish to make. In the first place the ankle-joint is not a tenon and mortise joint as is so commonly stated. It is much more of a condyloid character. The upper (transversely fairly oval) surface of the astragalus fits into the

oval space made by the malleoli on either side, and the hollowed-out lower extremity of the tibia. The fibula fits into a shallow groove in the outer articular rim of the lower end of the tibia and it is held firmly against this part of the tibia, not only by the interosseous membrane, but also by a special ligament, the tibio-fibula ligament. While some motion between the lower ends of these bones is possible, they are held together by very strong fibrous bands. Both malleoli are connected to the astragalus and calcaneum by ligaments. The inverted V-shaped ligament from the fibula side is longer, slenderer and much weaker than the connection on the internal malleolus or tibial side, by the broad powerful in-



Fig. 1. Diagram of a section through the ankle-joint vertically to show the bony surfaces and primary ligament.

ternal ligament, which extends not only to the astragalus but also to the side of the calcaneum.

The muscles chiefly concerned in this injury have narrowed to tendons at the point usually traumatized. Those on the inner malleolus side are the posterior-tibial tendon and the flexor longus digitorum which run in separate sheaths through the posterior groove in the malleolus, and behind these is the tendon of the flexor longus pollicis. Between the two last tendons run the posterior tibial vessels and nerve.

The tendo Achillis, which terminates the most powerful double muscle of the leg, is inserted posteriorly into the apex of the heel bone—the calcaneum, is superficial to and behind the flexor longus digitorum. On the outer side are the two peroneal tendons in the groove behind the external malleolus. In the mechanism of the injury these last, I think, play no important part.

\*The Chirurgical Works of Percival Pott, F.R.S., 1st American Edition, 1819, p. 248.



### THE CAUSE AND THE MECHANISM. PHYSIOLOGIC FEATURES OF THE INJURY.

In nearly all cases Pott's fracture is caused by the individual falling or jumping and landing on his feet or foot. As a matter of fact, in a jump or fall that results in this serious injury the subject does not land squarely on both feet, but is deviated a little to one side, and the momentum comes chiefly in one foot, and outwardly. In other words, the force is so applied that one foot is violently everted and abducted. I think the first effect is a dislocation of the tibio-tarsal joint, laceration of the internal lateral ligament, and laceration of the tibio-fibular ligament, and perhaps a fracture of the tip of the internal malleolus. If the force continues, the foot will be turned so violently outward that the leverage will produce a fracture of the fibula two to three inches from the tip of the external malleolus. The gastrocnemius then draws the heel backwards and upwards, thus causing the articular surface of the astragalus to dislocate backwards. The inferior end of the tibia will then be outwards and forwards; this produces an apparent shortening of the foot.

From this regular (as it may be called) condition of affairs, there occur many variations. I have seen cases in which the inferior end of the tibia was driven backwards and outwards and rested just under the violently stretched skin with the posterior tibial and flexor longus digitorum tendons in front of it and the flexor longus pollicis behind it. In other words, the end of the bone had gone between the tendons and, of course, had badly injured, though it had not severed, the bloodvessels and nerves in the malleolar space. Another variation in the dislocation that I have seen, was the astragalus driven up between the leg bones. The fracture of the fibula was higher up in this case than usual. I cannot recall any case of internal dislocation of the tibia at the tibio-astragaloid articulation with fracture in the lower third of the fibula. This kind of an injury might result from direct violence, however. Such cases have been reported. I have seen many cases of fracture of the fibula in its lower third, laceration of the internal lateral ligament, sometimes with fracture of the tip of the internal malleolus, without any appreciable dislocation at the tibio-astragaloid joint. These cases, undoubtedly, had at the instant of the injury a partial dislocation at this joint, restored by some fortuitous twist of the body or violent contraction of the leg muscles.

A classical Pott's fracture is, then, a partial dislocation of the tibio-astragaloid articulation, (of

course serious laceration of the internal lateral ligament occurs, sometimes a fracture of the sharp part of the internal malleolus also takes place), and fracture of the fibula in its lower third. The foot is in abduction and everted. The tibio-fibular ligament is torn. The external malleolus does not leave the side of the astragalus as a rule, and the astragalus is driven relatively far outwards; this pushes the internal malleolus outwards, also tips the superior extremity of the distal fragment of the fibula inwards against the side of the tibia, thus separating the two fragments of the bone very considerably.

The inferior end of the tibia is pushed outward and forward against the superficial soft tissues so violently that they are frequently broken, and a com-



Fig. 2. This diagram indicates the laceration of the ligaments and points of fracture in the bones which take place in a Pott's fracture.

pound fracture results. In ordinary cases the lower tibial extremity is pushed outward and forward and rests just under the skin, which is stretched tensely. The pressure of the ends of the bone against the skin is exceedingly painful. This causes violent contraction of the muscles, so that all the tendons about the ankle joint become rigid cords. The foot, fixed in its false position by the tetanic spasms of the muscles and jamming of the articular surfaces, is very rigid, and all attempts to move it causes intense pain.

The injury is, therefore, followed by considerable shock, and the patient will need some systemic treatment if seen in time.



## TREATMENT.

Unless the physician is prepared to make a permanent dressing I think first aid should consist merely in fixing the foot, by splints or cushions, in the position in which it is found. The patient should be transported to a hospital or to his home immediately, if possible, and he should receive the attention of the surgeon at once. It must be remembered that the injury causes intense pain and that the lower end of the tibia is usually pressing so forcibly against the skin that the blood current may be cut off and the skin and subcutaneous connective tissue may be devitalized, if the pressure is not relieved very soon.

When it is possible to use it, a general anesthetic should be employed, ether preferably, as gas-oxygen does not relax the muscles as thoroughly. Complete relaxation of the muscles is necessary for easy reduction of the injury. It is hardly proper, however, to use the word "easy" in connection with proper reduction of this fracture-dislocation. It is rarely, if ever, easy. Complete restitution of the bones to their proper places is almost impossible without a general anesthetic.

The splints or apparatus for retaining the foot in place should be at hand and ready for application before the anesthetic is administered. Rigid splints of boards or metal are rarely applicable in these cases. No one has ever suggested or invented a set of splints or a device applicable to every case of Pott's fracture. One must not apply the reduced injury to the splint but the splint to the individual injury. Therefore, I have for years preferred to make my own retaining apparatus for this fracture-dislocation. I use, and would recommend, plaster of Paris with strips of flexible wood worked in so as to meet the requirements of each case. After it has been molded as one desires, the plaster splint may be split, if necessary, in order to employ massage and passive movements, whenever it is indicated.

In the effort to restore the bones and fragments to their proper places, a picture of the condition must be kept in mind. The lower articular tibial end will be partially dislocated forwards and inwards, the tip of the internal malleolus may be broken off, the internal lateral ligament will certainly be lacerated and shreds of this ligament will be clinging about the end of the tibia, the tibial end may be thrust entirely through it. The astragalus will be dislocated outwards and tilted slightly backward from its proper axis. The tibio-fibular ligament will be torn asunder, the external malleolus will be in juxtaposition with the side of the astragalus, and the external lateral

ligament may not be torn asunder, but the fibula will have an oblique fracture about  $2\frac{1}{2}$  to 3 inches above the tip of the external malleolus. The superior end of the distal fragment will be tilted inwards against the shaft of the tibia and the lower end of the proximal fragment be separated some distance from the distal fragment. There will be much extravasation of blood and serum. The foot will be everted and abducted and in some cases foreshortened by the lower end of the tibia having slipped rather far forward.

*Reduction:* As stated before, the patient should be completely relaxed by general anesthesia, if his physical condition will allow.

The leg should be flexed on the thigh to relax the



Fig. 3. This diagram shows roughly the usual laceration of ligaments dislocations and displacement of bones which result from a Pott's fracture.

gastrocnemius muscle and an assistant should hold the extremity firmly in this position. The operator should stand facing the patient's supine body, then he should grasp firmly the patient's foot, one hand the heel, the other, the anterior metatarsal region. He should first make strong traction of the foot in the axis of its displacement. Gradually, while drawing firmly on the foot, he should turn it forwards and inwards and carry the movement until the foot is slightly inverted and adducted. If it is possible to do this, reduction will be accomplished. After bringing the foot to the position indicated, let it return to its proper, normal position, and flex and extend the foot at the ankle joint a number of times to ascertain whether motion at the joint is free and shows no grating or marked impediment in the movement. If there is much difficulty in flexion and extension, reduction has not been accomplished and another attempt must be made.



Several things may prevent proper reduction: 1. The fragment of the tip of the internal malleolus may be caught between the articular surfaces of the ankle-joint. 2. If the fragment is broken away from the external rim of the articular end of the tibia, this may slip in between the articular surfaces. 3. The lacerated external lateral ligament may cling to the rough edges of the fractured internal malleolus, and be drawn between the articular surfaces. 4. The lower end of the tibia may be caught between the tendons which are located back of the internal malleolus. By trying repeatedly and carefully, one may usually overcome the impediment offered by all but the last difficulty. Without an open operation, it is almost impossible without doing serious damage to the tendons, bloodvessels and nerves to disengage the bone when the end of the tibia is between the posterior malleolar tendons; I have tried it and I know.

Another good indication of proper reduction is to find the fibula fragments in good alignment. If the dislocation is properly reduced, as a rule the upper end of the distal fragment of the fibula, which had fallen inwards against the tibia, will have been brought outwards when the astragalus has been returned to its proper relative position because, as was stated before, the external malleolus usually holds firmly to the astragalus, so bringing the internal border of the astragalus back towards the internal malleolus by leverage restores the upper end of the distal fragment of the fibula to its proper place.

*Dressings. Splints:* When good anatomical reduction has been accomplished simple fixation of the foot is all that is necessary. There is no inclination to another distortion, except extension of the foot by contraction of the gastrocnemius and soleus muscles—so the foot must be fixed in order to prevent this. Unless one does succeed in reducing the dislocation, no apparatus will suffice to restore proper alignment and proper function. Practically, the whole problem consists in how to obtain a thorough reduction of the dislocation. No splint, apparatus, or position will do this, if it cannot be done by manipulation while the patient is under the anesthetic.

Dupuytren, Pott and a host of other surgeons have designed and suggested splints for this fracture. I would as a rule, prefer to use a molded splint of plaster of Paris, or silicate of sodium, with strips of flexible wood, to assist in making proper pressure and render the splint less bulky and heavy.

It will be best, perhaps, to put the foot up in a slightly inverted and slightly adducted position, for the first week, then remove the dressing, massage the foot and ankle-joint and lower leg, and reapply

a molded splint with the foot in its normal position. This splint may be split after it hardens and be removed in another week for massage and passive movements of the ankle joint, and be reapplied; to be removed every other day for movements and massage. Active movements begun just as soon as the tip of the malleolus is sufficiently stable not to be displaced, followed by massage, will do much toward restitution of function. While it is desirable to have the ends of the fibula fragments in good apposition, this is not absolutely necessary. Even if the union of these fragments is by fibrous tissue only, the function of the leg will be good. Therefore, it is not necessary to peril the joint by putting the foot into disagreeable and unnatural position, in order to bring the fibula fragments into anatomical position. The serious matter is, that if the ends of the fibula fragments are not brought somewhere near to apposition, considerable callus will result and later a fixation to the side of the tibia. This may result in irritation of the peroneal nerve and considerable neuralgia or neuritic pain. Besides, this will reduce the flexibility of the ankle and leg.

#### COMPOUND FRACTURES.

As was stated before, a Pott's fracture may readily become a compound fracture, when the skin is torn, and especially, when all or a part of the lower extremity of the tibia projects through the skin the most careful débridement should be done, both of all the soft tissues involved, and of the end of the malleolus (not the articular surfaces). The reduction should be made as in the case of a simple fracture-dislocation.

As a rule, a compound fracture is easier to reduce, because one may see what prevents the tibia returning to its place, and remove the obstruction by instrumental assistance. Great care should be employed not to injure the articular surfaces of the astragalus and tibia. Only a small drain of rubber tissue should be introduced through the most dependent portion of the wound as far as the torn ligament, but not within the synovial sac. The wound may be sutured, if necessary, then a thick dressing of sterile absorbent gauze should be applied and a plaster of Paris, or silicate of sodium splint over this. If no fever, nor much pain results, this dressing may remain on for two weeks. After this the treatment should be the same as for the simple fracture-dislocation.

*PROGNOSIS:* One should always be very cautious in his prediction of the result in a case of Pott's fracture. The result in the majority of cases, is, as regards usefulness, good, but it is rare to have a per-



fect restitution of function. The foot has four movements, as all condyloid joints have. Flexion and extension will, as a rule, be restored, but adduction and abduction will rarely be fully reacquired, and the ankle-joint will for a long time be thicker than the other one.

In rheumatic and gouty subjects this injury will likely be followed by periods of considerable pain, intermittent and exacerbating pains.

#### EARLY AND COMPLETE IMMOBILIZATION AS A FACTOR IN THE PRESERVATION OF JOINT FUNCTION IN THE TREATMENT OF FRACTURES.

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Nonunion, malunion and loss of joint function as results of fractures are still far too common. The figures of the Surgeon General's report as to the results of the draft, show that an astonishing number of men were barred from service because of bad results following fractures. There were more than 22,000 in all. If this percentage holds for the population of the entire country, the disability figures for poor results after fractures must be very high indeed. In very large part, disability following fractures is due to stiffness of adjacent joints.

I recently had an interesting and unusual opportunity to study methods and results in the treatment of fractures. In our service at the Savenay Hospital Center we received some thousands of wounded Americans from other hospitals in the American Expeditionary Force. These were approved for evacuation to the United States; splinted or operated upon as indicated by the condition in which they arrived. Each patient was checked upon arrival as to his condition. As far as possible, the patients disposition was decided upon at once and operation was performed, position changed, splint put on or he was listed for evacuation to the United States the same day.

Previous to this time, I had also had an experience of more than a year with the British, most of the time, at a Base Hospital in Wales. Here, as well as at London, Bristol, Edinburgh, Belfast and Liverpool, many patients were seen who had reached a much later stage in the evolution of similar injuries. Conclusions from these observations were so inevitable that one feels like expressing rather strongly his views as to what the conditions in civilian practice must be and what general rules must be observed with reference to the treatment of similar conditions.

Medical officers in the military service were regular and civilian. The regular officers were trained for and chiefly concerned with the military campaign proper and the proper conduct of the hospitals. I may say here, however, that having been directly associated with about twenty regular medical officers who were in command of hospitals or hospital centers, I found them always anxious and willing to do whatever was necessary and possible, for our American wounded. I am anxious to say this because I have seen and heard comments to the effect that points of discipline were sometimes placed before the welfare of the wounded men. I never found this to be the case.

Civilian medical officers were, as might have been expected, chiefly concerned with the strictly professional side of the work. However, a handicap that always existed on the part of the civilian officers, was their disposition to do things with professional or personal considerations uppermost, rather than in the military way. I am not competent to speak of the effect of this upon the military campaign. I may say, however, that the treatment of fractures improved directly in proportion to the degree in which we succeeded in getting the surgical staff to comply with the rules set down by the Chief Surgeon, and the consultants in surgery and orthopedic surgery for the care and especially the surgical treatment and splinting of patients.

We had at all times in France considerable difficulty in securing the essentials of treatment for fractures, namely, traction and immobilization. Every trainload of wounded that came to Savenay, brought from ten to forty per cent. of patients with fractures, simple or compound, joint injuries, divided peripheral nerves and muscle and tendon injuries with developing or developed deformity, without any splints whatever. The average, for several months, of such patients without splints, was twenty-five per cent.

There were two factors chiefly responsible for the fact that so many patients were splinted poorly or not at all: First, opposition to splinting by chiefs of services and ward surgeons, who were afraid of producing stiff joints. Second, failure to splint by those who did not appreciate its importance.

In certain areas, to be sure, there was an amount of rush and lack of provision for splinting, which served to excuse the conditions found to some extent. In general, however, the two factors above referred to were chiefly responsible.

The fact that these two same factors are constantly met in civilian practice, impels the writer of this



paper to lay the issue squarely before the medical profession. Stiff joints have been used a bugaboo and an argument against splinting long enough. The fact of the matter is, that stiffness after fractures is quite a different thing than is commonly supposed.

Actual bony ankylosis of a joint occurs with the destruction of the articular surface and formation of bone between the adjacent bony structures; this occurs in fractures only very rarely. On the other hand, severe stiffness is usually found in those cases in which there has been a long period of poor splinting without real immobilization and where there has been continued irritation, mechanical or infectious, or both. It is a very common thing for the tendons to practically unite with tendon sheaths, adjacent fascia and muscle sheaths.

In such cases, there is usually no bony ankylosis whatever. These conditions occur almost never as a result of immobilization. They do occur regularly with poor splinting, with continued irritation from motion and inflammation. That splinting and real fixation may be quite different things can be noticed in almost any general hospital. In other words, stiffness in joints after fractures is more often due to failure to immobilize than to prolonged fixation. Stiffness charged to splinting is practically always due to pathological changes in the soft tissues. In these tissues as well as in many ankylosed joints, stiffness would never have occurred if, by adequate fixation, the parts had been protected from the first against motion and consequent damage and more severe pathological change.

There are a few points that must be emphasized in this connection:

1. The usual splint applied to fractures does not immobilize at all. This applies even to the usual plaster of Paris cast.

2. A considerable number of splints applied to fractures that are followed by joint stiffness, have been put on too tight. This fault is as serious as having splints too loose. Even splints that are bandaged too tightly may not immobilize. Continued congestion of the extremities due to overtightness of a bandage may cause serious stiffness in the ligaments, fasciae, tendons and muscles without any bony changes, whatever.

3. Uniformity in results after fractures was obtained in France during the military activity more nearly by a standard method of splinting and bandaging, than has ever been accomplished in civilian practice.

4. In fractures of the femur, the general adopt-

ion of the Thomas splint, which gives traction and immobilization (if properly applied) either from the skin or from the bones themselves, without constriction, will contribute greatly, not only to better results in the alignment of the fragments, but also to a very great reduction in the amount of joint stiffness and disability after such injuries.

5. In other fractures, especially of the forearm, leg and spine, the more general use of plaster of Paris, applied so as to give real immobilization, will reduce the amount of pathological change, secure more rapid healing of the injured parts and give more and better function in adjacent joints than can be obtained in any other way.

### THE PATHOLOGY AND TREATMENT OF CHRONIC BRAIN INJURIES, WITH AND WITHOUT A FRACTURE OF THE SKULL.

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Interest in conditions of brain injury has been greatly stimulated during the past few years, this being due, to a large extent, to the frequency of gunshot and shrapnel cranial injuries in the recent war. In these direct brain injuries involving a more or less extensive destruction and loss of cerebral tissue, the gross pathology has been rather an obvious one—a penetrating wound of the vault with varying degrees of local bony change and, most important, the opening of the underlying dura with direct cerebral or cerebellar destruction; the associated subdural and intracerebral hemorrhage together with the cerebral edema was the usual cause of the increasing intracranial pressure sufficient to extrude cerebral tissue. The treatment of these acute conditions cannot be described in this paper and I shall limit my observations to those conditions of chronic brain injuries of civil life rather than of war—that is, of brain injuries associated and unassociated with fracture of the skull, and especially the so-called “fracture of the base of the skull”; brain injuries resulting from depressed fractures of the vault will only be mentioned.

The term “chronic brain injury” naturally presupposes a recovery of life from the acute condition—whether the treatment may have been the expectant palliative or the operative. In a rather large series of these patients, it has become my opinion that the operative treatment is indicated only in about one-third of the cases—only in those where the increased intracranial pressure due to hemorrhage or cerebral edema is of such a height that the recovery



of life and of future normality is more probable by the operative than by means of the expectant palliative method of treatment alone; in the other two-thirds of these patients in whom the increased intracranial pressure is not marked, the assistance of the expectant, palliative method of treatment to the natural means of absorption of the intracranial hemorrhage and of the excess cerebrospinal fluid will usually prove sufficient—not only for the preservation of life but also the recovery of apparent normality. The expectant, palliative treatment of these selected patients is frequently aided by profuse bleeding and discharge of cerebrospinal fluid from the ears or from the nose, extrusion of blood and cerebrospinal fluid through a fracture of the vault into the tissues of the scalp to form hematomata of varying size and, in selected patients, by the repeated lumbar punctures of spinal drainage, so that the intracranial pressure is not permitted to rise to a height necessitating the cranial operation of decompression and drainage. Naturally all depressed fractures of the vault should be either elevated or removed—whether an increased intracranial pressure is present or not—for fear of future complications of mentality, of the emotional reactions and of epilepsy; if in these depressed fractures, however, there is great increase of the intracranial pressure, as registered by the ophthalmoscope and especially by the spinal mercurial manometer at lumbar puncture, then the operation of elevation or removal of the depressed area of the vault should be preceded by an ipsilateral subtemporal decompression to lower this increased intracranial pressure, so that the local operation of elevating or removing the depressed bone can be safely performed and without damage to the adjacent and highly developed cerebral cortex, which otherwise might be extruded and therefore prove a rather dangerous means of decompression. In many of these latter cases, the chances of the patient would be better without any operation than with this method of local operation alone.

Just a word regarding the two stages in these acute conditions of brain injury when *no* operation should be performed—no matter how badly the skull is fractured nor how large the intracranial hemorrhage may be nor how imminent death seems: first, the stage of severe initial shock, and second, the stage of medullary edema—the terminal period. If a patient is in a condition of severe shock following the cranial injury so that the temperature is subnormal and the pulse-rate is 110 and even higher, in addition to the other signs of shock and particularly that of lowered blood pressure, then the treatment should be limited entirely to the treatment of the condition of shock;

any operation in this period would merely be an added shock for the patient to overcome, and if he should survive, then recovery is not due to, but rather *in spite of*, the operation. If the patient is unable to survive the shock of the injury itself, surely the additional shock of an operation will not aid him. For this same reason, prolonged neurological examinations of the reflexes, fundi, etc. should be postponed and all the efforts directed toward assisting the patient to survive the shock. When this is accomplished, then the most careful examinations are permissible and the appropriate local treatment possible—and the patient's chance of recovery is not lessened and even prevented. It is the general condition of the patient in this stage of severe shock that demands immediate treatment rather than the local condition, and an important factor in the high mortality of brain injuries has been the neglect in treating this general condition of severe initial shock.

The other important factor in the high mortality of brain injuries has been the frequent delay and postponement of a cranial operation until the natural resistance of the patient to a high intracranial pressure of hemorrhage or of excess cerebrospinal fluid has been exhausted during a period of hours (in those patients having an extreme intracranial pressure and particularly when due to subtentorial hemorrhage) or of days and even of two or three weeks (in those patients having an increased intracranial pressure of less severity and yet being unable to "take care of" it sufficiently by the natural means of absorption). If the patient has continued in the stage of medullary compression for a period of hours and even of days—as indicated clinically by the blood pressure being definitely increased above normal and by the pulse- and respiration-rates being irregular and retarded to even below 50 and, 10 respectively,—and then the pulse- and respiration-rates begin to rise rapidly, the blood pressure to fall and the temperature to ascend (the typical picture of medullary edema and the *terminal* stage), to advise at this late period any cranial operation "in the hope of giving the patient a chance", cannot be too strongly condemned as these patients all die with or without operation—in fact, any operation performed in this stage of medullary edema merely hastens the exitus. This period of medullary edema can usually be anticipated and even prevented in the treatment of brain injuries, either by the expectant, palliative method or by the operative method of cranial decompression and drainage when the clinical signs—and especially those revealed by the ophthalmoscope and by the spinal mercurial manometer—indicate a



marked increase of the intracranial pressure to such a height that it is doubtful if the expectant palliative treatment alone can lower it. To permit a patient to enter and to continue in the stage of medullary compression is running a very great risk—either of death or of permanent mental and physical impairment. But if the patient has advanced from the stage of medullary compression into that of medullary edema with an increasing pulse- and respiration-rate, no operation is advisable—the patient is not benefited, to say the least, and cranial surgery is merely discredited.

In a recent work upon the diagnosis and treatment of brain injuries\* I realize now that I did not emphasize sufficiently the relative unimportance (in my opinion) of a definite increase of the blood pressure except as indicating the lateness of the time for operative interference, since this increase of the blood pressure is a sign of medullary compression and the patient should be given an opportunity to recover by an earlier lowering of the increased intracranial pressure, either by the expectant, palliative or by the operative method. If we wait in the treatment until the blood pressure is definitely increased above normal, then we are letting the patient reach a very serious condition of medullary compression and it is then frequently too late to aid him even by an operation of decompression and drainage. In my opinion, the ophthalmoscopic and spinal mercurial manometric findings are much more valuable as definite and delicate tests in ascertaining early the intracranial condition of an increase of the intracranial pressure, whether due to hemorrhage or to an excess cerebrospinal fluid. Naturally, the presence of shock is characterized by a lowered blood pressure together with a subnormal temperature and an increased pulse-rate, whereas the stage of medullary edema presents a rising temperature, pulse- and respiration-rate and also a falling blood pressure, so that clinically these two periods may at times be confused.

During the past few years, the profession has been more and more impressed with the end-results in these patients; to be sure, the preservation of life is essential and yet the treatment of the acute condition should not be only to preserve life, but also to restore a condition of approximate normality, both mentally and physically. The attitude of the profession has largely been one of surprise if a patient with a "fracture of the skull" and particularly of

the base, recovered; and if the mental, emotional or physical condition was not so normal as before the injury, "well, he had a fracture of the skull and should consider himself fortunate to be alive". It has been this feeling of comparative helplessness that has permitted these patients to be very much neglected—it being considered that the mental and physical impairment was due to a definite gross primary brain lesion at the time of the injury and therefore, an irreparable condition. Fortunately, however, this is a fact in only a small percentage of the patients having had a severe cranial injury with or without a fracture of the skull, and these are the selected patients having the so-called "chronic brain injuries", that I wish to discuss here.

During the past eight years, I have had the opportunity to examine and to treat a large series of patients having acute brain injuries, and it has been very impressive to note, either at autopsy or at operation, the comparative rarity of extensive cerebral laceration in these patients. It is conceded that in large compound, depressed fractures of the vault and in the occasional gun-shot injuries in civil life, extensive cerebral laceration does occur and, therefore, if the patient should survive, an irreparable brain injury presents its symptoms and signs. Yet it is indeed most infrequent for gross tears in the cerebral cortex to occur in the usual cranial injuries with or without a fracture of the vault or of the base of the skull. At autopsy upon those patients who have died from the extreme initial shock or from an infective meningoencephalitis or from a terminal medullary edema resulting from high intracranial pressure of hemorrhage and of excess cerebrospinal fluid, the most common of cerebral lesions was a contusions of the superficial layers of the cortex of the anterior and inferior surfaces of either frontal lobe and of the tip of either temporo-sphenoidal lobe, but no extensive laceration—merely a bruising of these areas covered by a thin layer of localized supracortical hemorrhage. Even these findings, however, were not frequent. The most common post-mortem condition was a large amount of free bloody cerebrospinal fluid associated with a layer of supracortical hemorrhagic clot of varying thickness, the brain itself being swollen and edematous, of the so-called "wet" and "water-logged" type. This condition of supracortical hemorrhage and excess cerebrospinal fluid is also the usual operative finding and rarely is a gross cerebral laceration exposed. The relative infrequency of large cerebral lacerations is also demonstrated clinically in those patients who make such excellent recovery of function e. g., from

\*"The Diagnosis and Treatment of Brain Injuries, with and without a Fracture of the Skull," J. B. Lippincott Co., Phila., 1921.



hemiplegia, following most severe cranial traumata with and without an operative decompression, thus confirming the opinion that the immediate paralysis was due rather to local compression of hemorrhage and of cerebral edema than to a gross cerebral laceration. It is in those patients having a high intracranial pressure, especially when it is due chiefly to hemorrhage, that the subtemporal decompression and drainage is the treatment of choice, from the standpoints not only of recovery of life but also of the ultimate recovery of function.

We are concerned in this paper with those patients who have recovered from the immediate effects of the acute cranial injury and yet remain with symptoms and signs of definite impairment—severe persistent headaches, early fatigue, inability to work throughout the day as formerly, dizzy spells, a definite change of personality of the depressed or of the excitable and irritable type, and even epilepsy in its various manifestations. These are cases that form a most interesting group for study.

It is an opinion rather common among the laity and to a less extent in the medical profession, that once an individual has had a "fracture of the skull," he is never the same again—if not mentally and physically, then at least in the emotional reactions; that he is more irritable, with periods of depression or of excitement, frequently complains of persistent headache, has a sense of early fatigue so that the former day's work is impossible or at least difficult, occasional spells of vertigo and at times even epileptiform seizures. Definite changes of the personality have been very frequently observed, as manifested by less interest in surroundings and ambitions for the future, and unreliability to such a degree that he is termed a "loafer" and a "good-for-nothing". The condition of a large percentage of those patients was called that of "post-traumatic neurosis"—a functional disturbance resulting from the "shock" of the injury, "concussion" of the brain, etc., while the condition of the smaller number of these impaired patients was considered as being due to a gross organic injury of the brain at the time of the accident, such as cerebral contusion and lacerations associated with hemorrhage of varying degree. In the absence of macroscopic lesions to be observed with the naked eye, then the condition was held to be due to minute and possibly microscopic changes not only in the cortical nerve cells themselves, but also in their interrelationship and associated nerve tracts, and thus an irreparable condition.

With this post-traumatic condition in mind, in 1912 I attempted to ascertain the present status of

those patients at three of the large hospitals in New York City who had had a "fracture of the skull" during the preceding decade of 1900-1910. (The mortality of the acute condition was 46 to 64 per cent. while the operative mortality itself was 87 per cent. This latter was due chiefly to the type of operation performed, usually an extensive osteoplastic "flap" exposure, and the frequent performance of the operation during the initial stage of extreme shock or the terminal stage of medullary edema. Under these conditions, Doctor Pearce Bailey was undoubtedly correct in the belief that these patients "get along just as well without as with operation"). Of the total patients who were discharged from those three hospitals as "well", "cured" or "improved", I was successful in locating only 34 per cent., but of this number 67 per cent. were still suffering from the effects of the former injury—the chief complaints being headache, early fatigue, change of personality and, in a very small number, convulsive seizures. The records of these impaired patients were very instructive in that their hospital residence was usually longer than that of the other cranial injury cases by a number of days and even of weeks; while frequent notes were found of prolonged stupor and even of unconsciousness, of severe headache and of retarded pulse-rate—symptoms and signs indicative of an increased intracranial pressure; rarely was an ophthalmoscopic examination made and even more rarely had a lumbar puncture been performed. In examining these chronic cases, I was very much surprised to find in a large number of them the definite evidence of an increase of intracranial pressure, as observed with the ophthalmoscope and particularly with the estimation of the pressure of the cerebrospinal fluid at lumbar puncture. Upon nine of these selected patients, the operation of subtemporal decompression and drainage was performed even at this late date following the injury and the operative findings were all similar—no gross cortical lesions exposed, but a "wet", swollen, edematous brain under varying degrees of increased pressure; along the supracortical veins in the sulci, however, was a cloudy induration of new tissue formation surrounding the vessel walls, which were also thickened. Microscopical sections have now been made of this condition occurring in similar patients and also in children who had a supracortical hemorrhage at the time of birth; and this tissue formation is now recognized as the organization "residue" of connective tissue of a former layer of supracortical blood which had collected chiefly in the sulci about these veins and thus had blocked the little stomata of exit of the



cerebrospinal fluid through the walls of these vessels—the main channels of excretion of the cerebrospinal fluid into the blood streams. In this manner, a mild condition of external hydrocephalus had been produced by this partial blockage of the excretion of the cerebrospinal fluid.

Microscopic sections of the cortical cells and their normal arrangement have only rarely disclosed a definite change of structure, although this added complication cannot be excluded in any case. It is the pathologic condition, however, about the supracortical veins that has been overlooked in the past; and it has only been since we learned that over 80 per cent. of the excretion of the cerebrospinal fluid occurs through the supracortical veins lying in the sulci, that it was recognized that this condition of new tissue formation following the hemorrhage was the main lesion in causing the edematous brain of the *cerebrospinal*, with varying degrees of intracranial pressure. Those patients making excellent recoveries with the expectant, palliative treatment alone—and over 50 per cent. do, undoubtedly are the ones in whom the natural means of absorption have been sufficient to “take care of” the free supracortical blood, so that no real residue or new tissue formation results, since practically all of the hemorrhage has been absorbed. I have had the opportunity to demonstrate the confirmation of this opinion in three patients who had had cranial injuries with a resulting intracranial hemorrhage, as indicated by the bloody cerebrospinal fluid at lumbar puncture not sufficient, however, to produce a marked increase of the intracranial pressure, so that the expectant, palliative method of treatment alone was indicated and sufficient to obtain an excellent recovery. Later, upon death from other causes, autopsy in these three cases\* disclosed little, if any, new tissue formation about the supracortical veins in the sulci; the hemorrhage having been entirely absorbed, the brain was not edematous, there being no blockage of the excretion of the cerebrospinal fluid.

\*During the past seven years I have insisted, before performing an operation upon any patient having a chronic neurological condition, that the nearest relatives give me, in writing, permission to make a post-mortem examination in case the patient should die,—and naturally one does not expect the patient to die—in order to ascertain the real cause of death, rather than accept the common report of “cerebral or pulmonary embolus” and “thrombus formation”. If death is due to an operative error or to some avoidable complication, then it is for the surgeon to realize it so that its repetition can, if possible, be prevented in the future patients. Moreover, the accuracy of the diagnosis is thus confirmed or disproven and the pathological lesion is carefully examined. The co-operation of the nearest relative in permitting these examinations has been the rule; in only two cases in a series of over 1,000 operated patients was a flat refusal maintained—and no operation was performed.

Those patients who have had an intracranial injury, and most probably a supracortical hemorrhage, (with or without a fracture of the skull), who have not recovered their former normality, and in whom headache, early fatigue, change of personality or even convulsive seizures persist, should be most carefully examined from the standpoint of the presence or absence of an increased intracranial pressure as found in the fundi with the ophthalmoscope and more accurately still by the spinal mercurial manometer at lumbar puncture. If no increase of the intracranial pressure is present, then the treatment can be only of the expectant palliative type for the intracranial damage has already occurred, whether due to a primary gross or minute microscopic lesion of the cortical cells or to a prolonged high intracranial pressure which has gradually become lower as a result of the atrophy of the cerebral cells, a permanent impairment—a compensatory lowering of intracranial pressure at the expense of the brain itself. But if a definite increase of the intracranial pressure persists in spite of the usual expectant, palliative treatment, then the patient can be greatly benefited and improved by means of an early subtemporal decompression and permanent drainage of the blocked cerebrospinal fluid. The dura should naturally be opened widely and permitted to remain open and not resutured, otherwise the decompression is of only temporary value. Excellent results have been obtained in this class of patients and the earlier the condition of increased intracranial pressure can be lowered to normal, just so much more of an improvement can be expected from the operation.

In closing, let me merely mention the similar chronic condition occurring in children as the result of an intracranial hemorrhage at the time of birth—usually a difficult labor, with or without instruments. They are usually first children, and unless convulsive twitchings occur within several days after birth, or the child is unusually excitable or stuporous, the condition is commonly overlooked and the baby may be considered a normal child until the seventh or eighth month, and even later. Then it is observed that the child is not holding up its head, and later does not sit up or attempt to stand until months after the normal time; convulsive twitchings may or may not be present; speech is usually retarded—in fact, the entire physical and mental activities are delayed and retarded in varying degree. If examinations now show a marked increase of the intracranial pressure, these are the selected patients who can be greatly benefitted by subtemporal decompression and permanent drainage of the blocked cerebrospinal



fluid, even at the late date of several years following the injury—just as in the chronic brain injuries occurring in adults. However, the ideal treatment of these conditions of intracranial hemorrhage is at the time of the acute condition,—within the first few days following birth in the baby, and within a period of hours following the injury in adults. In these new-born, if repeated lumbar punctures with removal of large amounts of bloody cerebrospinal fluid, do not suffice to lower the increased intracranial pressure, then a modified subtemporal decompression and drainage operation is immediately indicated, just as in the acute brain injuries of adults having the symptoms and signs of high intracranial pressure. Infants who survive a birth hemorrhage, whose increased intracranial pressure has not been lowered to normal, cannot develop as they should, either mentally or physically. As a result of this condition there is produced that large group of spastic and defective children—the bane of the pediatricist, orthopedist and neurologist. After a lapse of years, however, the selected children having an increased intracranial pressure can be only improved by operative lowering of the pressure. I have now operated upon 419 of these children, out of almost 4000 cases examined, of ages varying from five hours to 23 years; and I may state that the lesion is practically the same as occurs in adults from cranial injuries with a supracortical hemorrhage. The persistent increase of intracranial pressure is due to the partial blockage of the excretion of the cerebrospinal fluid by the new tissue formation resulting from the supracortical hemorrhage about the veins in the sulci, producing the characteristic “wet”, edematous condition of the brain.

In conclusion, it is only in those patients having a definite increase of the intracranial pressure that any improvement can be afforded by means of the cranial decompression. Naturally, if minute changes have taken place in the cortical cells themselves, then an irreparable damage has occurred and even if the increased intracranial pressure is lowered to normal by operation, these patients cannot make a complete recovery of function, although the relief of the pressure should improve their condition. It is, however, in those patients in whom the increased pressure resulting from a partial blockage of the excretion of the cerebrospinal fluid is the main pathological condition and especially in those who have no organic cellular changes—that the operation of subtemporal decompression and permanent drainage affords the greatest ultimate improvement and, in the more fortunate ones, even an apparent cure.

20 WEST 50TH STREET.

## THE CHIEF LESIONS FOLLOWING SPINAL FRACTURE.

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Fracture of the spinal column with damage to the cord or roots is considered, and rightly so, a most serious injury. Though the spinal cord is the best protected structure of the body, once the bony canal is shattered the cord is most susceptible to injury, and its extremely low, or perhaps absent regenerative powers, makes it unique among the body structures. The integrity of the protecting bony canal once broken, it becomes a menace by reason of fragments driven into the cord, and the inelasticity of the meninges prevents the escape of inflammatory exudates, with resulting compression of the nerve fibers.

And even though the cord may have escaped noticeable injury at the time of the fracture, later, from new bone growth about the seat of the fracture, or to fibrous or scar tissue formation with adhesions both without and within the meninges, cord functioning may be seriously impaired. Conditions of spinal fractures with later disability, due to changes in the fractured vertebrae or to late cord impairment, are much less common than fracture with immediate cord involvement, but they do occur rather frequently. The signs of late cord or bone involvement are often extremely difficult to diagnose correctly, for the symptoms of the original fracture may have been slight, or the fracture may have been overlooked entirely. This is apt to happen if other parts of the body are also injured. Or the signs of cord impairment may closely simulate the sign of a chronic organic cord disease, as myelitis or multiple sclerosis. Or true organic cord disease may follow a spinal fracture in which the cord has apparently escaped damage.

A few years ago I operated upon a man of 28, who had received a severe injury to the spine in a fall 12 years previously. As there was no apparent injury of cord or bone, no roentgenogram was made, and the condition was diagnosed as a “severe sprain of the back”. Three years later he developed the signs of multiple sclerosis—pasticity of legs, absent abdominal reflexes, and pallor of the optic discs. The condition slowly progressed during the following years, so that when I saw him he was markedly disabled, getting about on crutches. The symptoms were undoubtedly those of multiple sclerosis, but because of the history of an injury to the spine a roentgenogram was made. This showed marked deformation and thickening of the laminae of the eleventh and twelfth dorsal vertebrae. Laminectomy disclosed



the affected laminae more deformed and thickened than was apparent in the skiagraph. There was a marked kyphosis of the cord at this point, and the reason for this was found to be either a dislocation backward of the eleventh dorsal vertebra, or extensive callus formation of the posterior surface of the vertebral body. Beyond some lessening of the spasticity in the legs, no improvement followed the operation.

It has been my experience that spinal evidence shown in roentgenograms falls short of the condition found at operation. The spine, especially in the thoracic and upper lumbar region is a difficult part to radiograph, and because of the arrangement of the bones roentgenograms of the spine are difficult to read. This difficulty can be overcome in part by making several views of the suspected part of the spine at different angles.

Many patients are seen with old fractures showing cord lesions upon whom for various reasons no operation was done, or if done, it was not very successful. In some of these patients upon whom an operation was done with little or no improvement, careful examination will show that the lesion was not correctly localized, and that the laminectomy had been placed some distance from the site of the trauma. Naturally, it is of paramount importance that the site of the trauma to the cord be positively identified before proceeding to operate. While in the majority of cord traumas localization is not difficult, especially with the aid of the  $x$ -ray, yet occasionally in young children, if there is little or no bone deformity, it may be very difficult to decide the exact location of the lesion. Unless the surgeon has determined to his own satisfaction the site of the injury, it is better to defer operation until he can be certain, and not subject the patient to a possibly useless laminectomy.

Some years ago I operated upon a child of seven years, who eight months previously had fallen from a height, causing paralysis of legs and sphincters. The  $x$ -ray picture showed no deformity of the spine, and a laminectomy three days after the injury, at the level of the sixth and seventh dorsal vertebrae revealed no lesion of the cord.

When seen by me eight months later the degree of paralysis of legs and sphincters was the same as described at the first operation. Another roentgenogram showed an apparently normal spinal column. Repeated careful examinations located the lesion at the third dorsal vertebra. Laminectomy at this point revealed many adhesions between the cord and meninges, the large amount of fluid in the

meshes of the adhesions giving them a cystic appearance. The cord was surrounded and compressed by a dense mass of yellow fibrous tissue due to old hemorrhage. But little of the scar tissue could be removed, and but little improvement followed the operation. The first operation, if done at the proper site, would have removed the blood clot and offset the edema, and would doubtless have been of much benefit.

Patients with cord lesions due to old fractures present symptoms varying from atrophy of a muscle group, foot drop, moderate spasticity of one or both extremities, to severe paralysis with impairment or loss of sphincteric control. Some of these patients had shown a gradual though partial return of function after the initial trauma, and operation was withheld because of this improvement. Later on improvement ceased, leaving the patient more or less disabled. In some of the patients retrogression had set in after the initial improvement and they gradually became more disabled. Naturally, restoration of function occurred in those portions of the cord undamaged, or not severely damaged, by the initial injury. But we should not conclude therefore that the cord tracts not regaining function are destroyed. Other factors besides laceration can prevent their functioning. Others of these patients with old fractures, and these usually of the type having mild cord involvement at the time of injury, show a gradually increasing impairment of function. Here the signs point to, and an operation will disclose, either mild compression by bone with resulting inflammatory thickening of the meninges, or organization and contraction of blood clot, or adhesions between pia and arachnoid with collection of fluid, and resulting compression of the cord tract. Or new bone growth (callus formation) may be revealed as the cause of the increasing cord impairment.

These patients are usually regarded as having suffered permanent damage to the portions of the cord showing impairment, and operation is rarely recommended because holding out little or no promise of benefit. But many of these patients can be improved by operation, even at a late date, and in some a brilliant result is secured. These patients should not be abandoned as hopeless cripples merely because a period of several months, or even years, has elapsed since the injury was received. Although it is too much to expect that operation will completely relieve many of these conditions yet definite improvement may follow laminectomy even at a late date.

However, the many reported cases of benefit re-



sulting from late operation, when symptoms of recovery cease or retrogression has set in, only indicate the good that could have been done by early operation, for the factors of continued compression, bone, hemorrhage, edema or scar tissue, that brought improvement to a standstill had certainly worked harm that would have been prevented by an early operation.

In a large proportion of these patients, the *x*-rays will disclose no displacement or thickening of bone, and operation, if undertaken, will confirm the negative *x*-ray findings. And yet in many of these old conditions of fracture, a simple exploratory or decompressive laminectomy, will often give astonishing and brilliant results. Then what was the cause of the disability? The initial injury produced undrained hemorrhage in or about the cord, later scar tissue and adhesions formed about the cord and in the arachnoid and dura, and these lead to the production of sacculations filled with fluid. I have seen patients in whom the arachnoid was adherent at some points with fluid-filled sacculations at other points, giving the appearance of multilocular cysts. This condition, alone, by compression is capable of giving rise to marked signs of cord impairment. When such a condition is encountered the arachnoid should be widely opened, and the adhesions divided to allow the proper flow and return of spinal fluid, and to prevent sac- or cyst-formation. Under no circumstances should the attempt be made to dissect scar tissue from the cord. If this is attempted the condition will almost certainly be aggravated.

There are, however, a large number of spinal fractures in which the cord and its roots escape damage. According to Pearce Bailey, in almost one-third of the cases of fracture of the spine, the cord escapes injury. This estimate in all probability is too low, as a large number of patients with this type of spinal injury are treated in the orthopedic clinics and the majority of them are not reported. In many of these injuries, there is but little alteration of the normal spinal curve. Unless careful examination is made, these conditions are apt to be diagnosed as "sprains or contusions of the back". In others, the amount of bony deformity and angulation is such that it is rather difficult to understand how the cord escaped involvement. In two fractures of this type, reported in a previous article, the vertebral bodies were almost completely crushed, yet these patients were able to stand and move about after the accident. As we know that many of the posterior arches, or laminae, can be removed without materially weakening the spine and since, as we have just said, crush-

ing of a vertebral body does not render one unable to stand erect, it is apparent that the main support or strength of the spinal column lies in the articulations on the transverse processes. Moreover, it is rare in fracture by indirect force to have the cord injured (except by hemorrhage) unless there is rupture of these articulations. The converse is also true, that the most severe injuries of the cord are seen when these articulations are ruptured,—the familiar unilateral or bilateral fracture-dislocation of one or more vertebrae.

In many fractures of the spinal column without cord signs, the fracture has been entirely overlooked. Thus, in the case of a woman, reported in a previous article, who fell on a stairway striking the back on a step, there were no immediate signs of nerve involvement and a fracture was not suspected. Months after the accident and when all pain had long since disappeared, signs of cord impairment appeared and gradually increased. Only when the cord signs became marked was attention directed to the old accident and the *x*-ray picture disclosed much callus formation at the site of the injury, the twelfth dorsal and first lumbar vertebrae.

In the absence of cord signs and evident protrusion, or "knuckle" of the spine, the diagnosis is apt to be "simple sprain" or "contusion". If other injuries are present the spinal fracture without cord involvement is apt to be overlooked. In one such patient, who sustained severe burns of the arms and shoulders, in addition to the injury of the back, the burns were treated as the principal lesion and in the absence of cord signs, no attention was given to the spine, though the patient complained of pain in the lumbar region. Three weeks later, when the burns were nearly healed, the persistence of the pain directed attention to the spine, and examination revealed alteration in the normal spinal curve in the dorso-lumbar region. The *x*-rays disclosed crushing of the body of the twelfth dorsal vertebra. These instances indicate the necessity of careful examination, both clinical and by the *x*-ray, of all cases of suspected injury to the spine. Although in many of these conditions the failure to recognize a spinal fracture does not result seriously, it is readily conceivable that in a patient able to move about in bed, with the fracture not immobilized, sudden twisting or turning movements by the patient or his attendants, may easily convert a fracture without cord signs into a fracture with serious cord involvement. Also failure to recognize a fracture and to restore the normal spinal curve may result in a weakened spinal column and more or less permanent disability with perhaps ap-



pearance later of cord symptoms due to new bone formation. This latter condition is more often seen when the fracture occurs in the laminae of the vertebrae.

*The treatment of fracture of the spinal column without cord symptoms* is immobilization. In fracture of the cervical vertebrae, immobilization is best secured by a plaster collar so applied as to hold head and neck rigid. If the fracture is high in the cervical region, an extension should be made from the collar about the forehead. If the fracture lies in the lower cervical region, an extension should also include the upper trunk. After from six to ten weeks, when all pain and tenderness have disappeared, the plaster may be followed by a stiff leather collar, which gives support, but is more comfortable and allows greater freedom of movement. If the fracture lies in the laminae of the dorsal or lumbar vertebrae, a moulded splint of plaster on each side of the spinal column, connected by transverse bands above and below the lesion, will be found the most satisfactory way of immobilizing the fracture and preserving the normal outline of the spinal processes. Fracture of a vertebral body, or bodies, if seen soon after the injury, is best treated by hyperextension on a Bradford frame, for the purpose of removing the "knuckle" or angulation and restoring the normal spinal curve. If, as often happens, the fracture has not been discovered until some weeks or months have elapsed, it will be impossible to correct the deformity and the patient, though getting firm union, will have a permanent "knuckle" or angulation and some disability. When the Bradford frame is employed the patient is confined to bed until all pain and tenderness have disappeared, (a matter of some weeks). A series of plaster jackets must then be worn continuously for ten or twelve months. A steel back brace is then substituted for the plaster jacket, and should be worn until twenty to twenty-four months have elapsed since the injury.

If the patient will consent, the period of convalescence can be shortened to about twelve months, by doing one of the several spine fixation operations such as the Hibbs or Albee operations. The advantages of the open operation are that it gives firm union and shortens the period of recovery to about twelve months. Its disadvantages are: danger of sepsis (not great); breaking down or non-union of the graft; and the fact that operation makes permanently rigid a larger portion of the spine than does the plaster jacket method. This last is not very important as permanent fixation of several vertebrae in the dorsal or upper lumbar region will not

seriously inconvenience the patient. Of course the plaster jacket should be worn for months after any of the spine-fixation operations. It is my opinion that if the injury has resulted in the partial destruction of only one vertebral body, it is best treated by the plaster jacket method. If, however, one, two or more vertebral bodies have been badly crushed one of the open operations will give firmer union and better functional results. Under either method of treatment though the patients may recover with firm union at the point of fracture, few of these patients doing active manual work previous to the injury will return to the same sort of work. Many of them are not able to, especially those in whom the injury was to the lower spine. The long period of convalescence is probably partly responsible and loss of confidence may also be a factor. In all the fractures without cord damage that we have seen in the cervical region, the spine, after twelve to fifteen months, was normally strong and supple, and it is probably the fear of another injury that keeps these patients from their former work.

*Recent fractures of the spinal column presenting immediate signs of cord involvement*, can be divided, on a pathological basis, into two classes; those showing signs of partial lesion of the cord, and those showing signs of complete cord lesion. But from the clinical standpoint we cannot so divide them. For many fractures showing immediate signs of complete cord lesions are really conditions of partial, at times slight, cord injury. For in addition to the loss of function of the damaged fibers, the shock or jar of the injury may cause an inhibition of function of the sound fibers more or less complete for a variable period of time. Few patients having injuries of this type short of a complete transverse lesion, will be as seriously disabled eventually as they appear to be shortly after the injury. For to the motor paralysis and impairment of sensation due to the laceration of nerve fibers, is added this inhibition of function due to the local shock of the trauma. This will disappear in time, (days or weeks) and if we possessed signs that enabled us to distinguish between laceration of fibers or tracts, and inhibition of function due to concussion, surgical interference would not be so necessary, as operation can do nothing for lacerated cord fibers.

In patients with recent fractures showing signs of partial abolition of function there is partial and irregularly distributed motor paralysis with abolition of some of the reflexes and areas of anesthesia below the site of the injury with probable disturbance of sphincteric control. In these instan-



ces the signs are due either to contusion, laceration or compression of the cord by the crushed vertebrae or to compression by hemorrhage in or around the cord.

Experimental studies of contusion of the cord show, in proportion to the severity of the contusion, disintegration of the axis-cylinders; but this is usually less marked than in conditions of compression. In continued compression, in which the hemorrhage becomes an added element, the nerve fibers disintegrate and finally liquefy. It should be born in mind that, even though there may have been no laceration of cord fibers, even a moderate degree of compression if suddenly applied, as is the case with fracture, will cause more serious and permanent damage to cord fibers than a greater degree of compression gradually applied, as in tumor.

In partial lesions of the cord there are found destroyed, damaged and sound fibers side by side. Of the destroyed fibers nothing is to be expected; they will not regenerate. The fate of the damaged, and of many of the sound fibers, depends on whether the factors producing the injury are temporary or permanent. These factors are compression by bone, blood, and the certain edema which appears after every injury to the cord. If this compression is quickly removed, not only will the sound fibers be preserved, but functional and even anatomical repair will take place in many of the damaged, but not in the destroyed fibers. But if compression due to any or all of the above-mentioned three factors is at all severe, and is allowed to continue for as short a period as four days, not only will secondary degeneration appear in the damaged fibers, but many of the sound fibers will also be involved.

Also in contusion of the cord hemorrhage and edema, at least edema, are always present and if not relieved early by operation will increase the ultimate impairment. F. A. Allen demonstrated the harmful effects of this edema, by the improvement that followed experimental incisions into the cord after spinal fracture in animals.

There are, however, many fractures with milder degree of cord injury, in which there is no immediate loss of function. In this condition shortly following the injury, there are cramps in the legs, burning and tingling of the skin of the legs followed by a progressive loss of power and sensation. The signs indicate not laceration but compression of the cord by bone or hemorrhage. The progressive march of the symptoms shows, not a further narrowing of the bony canal, but an increase of the hemorrhage and arrival of the destructive edema. Here early lam-

nectomy is imperative if we would save the cord, or parts of it, from permanent injury. Even if no large hemorrhage is present, there may be a backward dislocation of the vertebral body, so that the cord is "kinked" and the canal narrowed; even if it is impossible to remove the bone projecting into the canal, the laminectomy gives the cord ample room to curve over it, and allows for the escape of the inflammatory exudate. Even if the signs of cord injury are but slight, if they are progressive, laminectomy should be performed and the dura opened to allow drainage of whatever hemorrhage may be present, and to ward off by this "spinal decompression", the effects of the edema which invariably follows the injury of the cord, and which is so destructive to the delicate fibers. Naturally, where there is no bony displacement, and the signs of cord injury are slight, and improvement begins almost immediately and continues, operation is not advisable.

It is in spinal fracture with signs of immediate complete abolition of function that the opinion of surgeons is most sharply divided as to the advisability of operative interference. Many hold that immediate complete motor and sensory paralysis, with abolition of all reflexes below the lesion and loss of sphincteric control, shows a total transverse lesion of the cord, and laminectomy is unjustifiable and can do no good. This would be true, did the above symptoms positively indicate, as they do in many instances, complete destruction of the cord. But there have been many instances reported in which all of the above signs were present, and which were considered complete lesions of the cord, in which, later, partial function returned even without operation, and many reported in which operation was followed by fair recovery. The Bastian-Bruns so-called law, which is that there is a total loss of tendon reflexes in complete lesion is, as an aid to diagnosis, only of value in the negative sense. That is, the presence of reflexes makes it certain that there is not a total lesion, while the absence of reflexes is not proof that the lesion is total unless such absence is persistent. In many instances of partial lesion, there is a total loss of reflexes for more than eight days. This is due to concussion interrupting nerve conductivity and is a condition from which the fibers recover. There are no signs, short of a deformity at the site of injury so great as to show complete obliteration of the bony canal, which prove a complete transverse lesion of the cord.

It has been regarded by many that complete abolition of function below the injury must indicate, if not laceration, at least most severe compression of



the cord. This is by no means necessarily the case. Alan Newton has shown by experiments in animals that the spinal cord is extremely sensitive to light degrees of compression. He found that a glass rod gently placed on end on the exposed cord arrested conduction immediately. After removal of the compression, conduction returned after an interval varying directly with the duration of the compression, and the amount of interference with function remaining after eleven to fourteen days following the experiment depended on the same factor. These results of Newton's experiments are in themselves a strong argument for the early operation, showing the beneficial effect of early removal of pressure due to whatever factor.

Bastian, Kocher and others have outlined signs that indicate complete lesion of the cord, but the instances described above and many others, show that these signs do not prove destruction of the cord, and that we cannot rely upon them. Kocher believes that operation is unjustifiable in case signs of complete lesion are present, and favors operation in partial lesion only when the symptoms have come to a standstill. But, as we have seen, the signs of complete lesion are not absolutely trustworthy, and delay in partial lesions may irreparably damage the cord. A much more rational stand is that taken by Dr. Walton who says: "Early operation will not only accomplish all that later operation will do for these cases, but will do it better".

*Treatment.* There has been, and still is, a rather marked difference of opinion as to the proper treatment of these injuries. Many neurologists and surgeons contend that in the majority of fractures of the spine with cord involvement, a policy of watchful waiting without operation is the better treatment, until the cord has demonstrated its ability or inability to progress towards normal functioning. On the other hand, some few of us surgeons and neurologists, insist that in the majority of these injuries early laminectomy after the patient has recovered from shock of the trauma, is the more rational treatment, and yields by far the better results.

In the discussions that have gone on in late years the opponents of early operation have maintained that laceration of the cord cannot be remedied by operation, and that the nerve fibers, if severely injured, degenerate whether compression is immediately removed or not. That removal of pressure by early operation will not cause the already destroyed fibers to regenerate is true. But the opponents of early operative interference have apparently overlooked several important facts. One is that in frac-

ture with damage to the cord, short of a complete transverse lesion, there are many fibers and tracts that escape injury wholly or in part. And there are other factors that will work harm to the nerve fibers in addition to the damage received at the moment of injury. If operation is not done, compression by bone, hemorrhage, or the quickly following edema, will destroy the already damaged fibers and involve many of the sound ones. Interruption of conductivity of nerve fibers after fracture does not necessarily mean that those fibers are destroyed. In practically every instance of damage to the cord, short of complete lesion, many of the interrupted fibers will later functionate, and it is to preserve the integrity of the sound fibers, and to give the best chance of recovery to the damaged but not destroyed fibers, that early operation is urged. In former years laminectomy was a formidable procedure, and operation was delayed on this account. But at the present time the danger of laminectomy in skilled hands is but slight in comparison with the possible benefits.

Signs of cord injury in fracture are due to the following factors:

1. To fragments of displaced bone causing contusion, or laceration of the nerve fibers, or a narrowing of the canal by the fractured laminae, or projection backward of a vertebral body, causing compression of the cord. In these conditions the signs of cord injury arise immediately after the accident.

2. Hemorrhage, either into the cord substance (hematomyelia) causing laceration of the fibers, or hemorrhage around the cord, either intra- or extradural, causing compression of the cord. In these conditions the signs of cord involvement come on shortly, perhaps hours, after the injury, and are usually progressive.

3. Edema, both within and around the cord, causing compression of the fibers. In considering the compressive effect on the cord of edema, it should be borne in mind that the cord substance is surrounded by a closely fitting envelope, the pia, which sends trabeculae into the substance of the cord, which support and maintain in position the almost jelly-like substance of the cord tracts. The spinal pia is thicker and less elastic than the pia mater of the brain. Unless the fluid can escape, edema arising within the cord after injury will cause compression of cord fibers, and is a serious menace, not only to the damaged fibers but also to sound ones. Edema within the cord itself is much more dangerous to cord integrity than a much larger collection without the cord, that is, in the subarachnoid space. In itself edema gives rise to symptoms that appear like those



due to hemorrhage, some hours after the accident, and these symptoms are progressive. This edema, present after every injury to the cord, and by its compressive effects so destructive to nerve fibers, forms one of the chief reasons for early operation. Its power to harm has been overlooked in the past, and recent operations have shown that in many instances, signs indicating injury or compression by bone are really due to the compressive and destructive effects of the edema.

4. Narrowing of the spinal canal at the site of injury by new bone growth or the formation of scar tissue. In this condition the signs arise months after the injury.

These factors operate singly or in combination. It is only in rare cases and in the slighter injuries that these factors operate singly. In the majority of fractures of the spine, two or more, and at times all of these factors are seen. That is, in fracture with laceration or compression of the cord by displaced bone, there is usually hemorrhage in or around the cord, always followed by edema, and often later by narrowing of the cord space by new bone growth or scar formation. However, in nearly every instance one factor, such as compression by bone or hemorrhage in or about the cord, so predominates as to render the other factors negligible for the time being, though later these other factors will add their quota to the sum total of the symptoms and have a strong effect on the result. It must not be forgotten in making a diagnosis and determining the probable factor or factors in the causation of the cord signs that, as mentioned above, immediate interruption of conductivity, whether partial or complete, does not necessarily mean laceration of the fibers or tracts interrupted.

One stated objection to the early operation, or in fact to any operation in the absence of deformity, is that in many reported instances of early laminectomy, little or no improvement followed, though no displaced bone was found; "and as the cord appeared normal, the dura was not opened." Such observations are similar to those regarding so-called cranial decompressions when the dura is not opened. Compression of cord fibers by edema will not be relieved by the removal of the laminae alone. Just as in head injuries, removal of bone will not relieve the intracranial pressure unless the dura is also opened, so in spinal fractures, a free opening of the dura is most important and should always be made.

It is said by many surgeons that early laminectomy adds insult to an already damaged cord, and yet these surgeons advise in mid-cervical fractures with dan-

ger of involvement of the fourth cervical segment, the spinal center of the phrenic nerve to the diaphragm, immediate operation to prevent respiratory trouble.

Immediate loss of power and sensation in parts of the body below the fracture points to the laceration or the section of the cord. Here the indications are for an early operation, not for the sake of the destroyed fibers, but with the view of warding off the compressive effects of the fast following edema, thus preserving the sound fibers and giving the best chance of recovery to the fibers damaged but not destroyed.

Therefore, I believe that in every patient having a fracture of the spine with damage to the cord, excepting only those conditions with signs of very slight cord involvement followed by immediate improvement, and at the other extreme those fractures showing complete obliteration of the bony canal, an early laminectomy is urgently indicated to relieve the cord of the damaging effects of bone pressure, hemorrhage and edema and to give the nerve tissue the best possible chance for repair.

By the term "early operation" is meant a laminectomy after the patient has rallied from the initial shock of the injury. Naturally, if the injury has been so severe or if the patient's vitality is such that he cannot rally from the condition of shock any operation at this time will hasten death. A safe general rule to follow is not to operate while the pulse is above 110. The operation should be performed as soon as the patient has reacted from the shock and the site of the injury is localized. A free opening of the bony canal will relieve compression by bone, whether due to driven-in laminae or a backward projecting vertebral body causing angulation of the cord. If a projecting vertebral body presses against the cord in front in spite of the removal of the laminae, sufficient bone can be chiseled or rongeured away to give the cord ample room. A free opening of the dura will permit of removal and drainage of blood, and will offset the compression effect of the subsequent edema. The dura may be reclosed or not as indicated by the condition of the cord. In very many cases it is best left open. The technique of the operation is briefly as follows:

A single incision is made in the median line down to the tips of the spinous processes. The muscles are then incised close to the spinous processes, down to the laminae on each side and the incisions packed with hot wet cloths to prevent bleeding. The laminae are freed of muscle by a broad periosteal elevator and a self-retaining retractor is then inserted,



which gives good exposure and effectually prevents bleeding. The spinous processes are removed by large special rongeurs and the laminae are rongeured away out to the transverse processes, giving a good exposure of the canal and cord. Bone fragments, if present, are removed, before the dura is opened, and any portion of a dislocated vertebra projecting far into the spinal canal is removed by rongeurs or chiseled away. The opening of the dura and arachnoid allow for escape of blood or serum, and if the cord is tense and swollen a small longitudinal incision carefully made in the posterior column will afford drainage. A drain at either end of the wound extending to the dura, or at least to the bottom of the muscle wound will provide an escape for wound fluid. The wound is closed by layer sutures to obviate dead spaces. A narrow posterior splint to the spine will prevent movements of the trunk and give the patient much comfort. When he is able to get about a plaster jacket is applied to be worn for at least a year.

What shall be done in those instances in which at operation the cord is found completely divided? It is almost generally agreed at the present time that cord fibers once severed do not regenerate. Murphy said that if the cord is severed, approximation will avail nothing. However, of the five instances reported of severed cords sutured, four were living several years after operation, while without suture no patient has lived over a year. The great improvement following suture, in the sensory and trophic disturbances, thus averting the terrible bed sores, warrant sutures for this alone. I believe that suture of a severed cord should be attempted. While I believe this to be the proper procedure, it will not often be found feasible to attempt it in fracture. For in this condition the cord is rarely cleanly cut, but is apt to be crushed for a variable distance, a distance too great to be bridged by sutures. If the ends cannot be approximated and the lesion is in the dorso-lumbar region an attempt should be made to unite the roots above and below the lesion, as suggested by Basil Kilvigton. This cannot be done in the upper dorsal or cervical region because of the short course of the roots in the canal.

#### *Summary of Advantages of Early Laminectomy.*

1. It removes pressure from the cord, whether due to depressed bone or to blood clots.
2. In a fracture-dislocation, it allows the cord ample room, relieving the pressure effects of angulation.
3. It provides drainage of the certain edema,

which by its compressive effects is destructive to the nerve fibers.

4. It allows for drainage of blood, if present, the compressive effect of which may be so great as to permanently damage the cord.

5. In skilled hands, laminectomy is not a difficult or dangerous operation, and by doing it early the surgeon has given the damaged cord the best possible chance for repair.

## THE BEDSIDE ROENTGENOGRAPHY OF FRACTURES.

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### APPARATUS

Previous to the war the portable apparatus utilized was exceedingly clumsy, cumbersome and required considerable skill for successful operation. During the war, there was developed for use in the United States Army a compact and efficient apparatus suitable for the usual varieties of current supply. This unit consists of a cabinet 36 inches high and 24 inches wide, mounted on rubber-tired wheels, and having attached a very complete tube-holding device capable of movement in all directions and retention in any given position. Within the cabinet is a small high-tension transformer of 60,000 volts, and in the base a small inverted rotary converter with a double-throw switch. This apparatus can be attached to the ordinary lamp socket, and if the current be alternating a simple push-button switch turns the x-ray on and off. There are no controls, a simple off and on switch being employed. The tube may be excited by a current of 5 to 10 milliamperes at about 60,000 volts.

The only factors under control of the operator are time of exposure and distance from tube to plate. If the current be a direct one, the switch is thrown to the other side and the inverted rotary converts the direct into alternating current, and the apparatus works as usual.

The output of the machine is small and its capacity limited, but experience in hospital wards has shown that this little apparatus is capable of making entirely satisfactory roentgenograms of all portions of the body, except the gastro-intestinal tract. Moreover, it is extremely transportable and requires no accessory wiring but can be used from the ordinary hospital lighting circuits. The surgeon is enabled in his fracture cases, for example, to determine the efficacy of his retentive apparatus and the degree of reduction of the fragments with their position, etc.



The secondary circuit contains no rectifying device, since the Coolidge tube for which the unit is adopted rectifies its own current.

For use with these units, Coolidge devised a special, air-cooled, finely focused, small-bulb tube, which possesses the unique property of continuously rectifying high-voltage alternating currents, suppressing one phase and utilizing the admitted phase for the production of  $x$ -rays. This radical invention at once permits the discarding of the cumbersome synchronous motors and mechanical rotating rectifying switches previously considered indispensable for this purpose. It consists of a glass bulb, containing a practically perfect vacuum. The cathode is a filament of tungsten wire which may be heated to incandescence by a passage of a 12-volt electrical current. Placed within the tube at a distance of about one inch is a copper anode or target faced with a small button of tungsten. This copper target is prolonged as a thick copper rod emerging from the end of the tube through a scaling-in platinum sleeve which provides an air seal and an expansion joint. Attached to the end of the rod, and removable for transportation purposes, is found a series of copper radiating fins, which may be placed in close mechanical contact with the shaft. These fins have a considerable radiating capacity, and, due to the conductivity of the copper, carry away and dissipate into the outside air the heat generated by the impact of the electrons against the focal spot on the target. Over the tube is slipped a lead glass sleeve with a single opening for the emission of the ray.

This apparatus, transformer and tube, by virtue of their ease of transportation and simple design have now come generally into use as bedside instruments.

Besides this army type there are numerous other types of apparatus all of which are built upon the same principle. But all operate best when used with the self-rectifying Coolidge tube. All these apparatus have the same parts, an oil-immersed high tension transformer, auto-transformer control, filament regulator, volt- and ampere-meters, switches for main line voltages, and an attachable rotary converter for direct current. They are all operable on 115 volt direct or 110 or 220 volt alternating current. These equipments have no rectifying device. The alternating, high-tension current is passed directly into the Coolidge radiator tube which rectifies the current, cutting out that alternation which travels in the wrong direction.

When it is necessary to carry the bedside unit from ward to ward, it may be suspended by the handles on

a litter made of timbers of sufficient strength and fastened together by two crosspieces. It consists of two timbers 2x3 inches, 5 feet long, set 16 inches apart, and held together by two crosspieces 3 feet apart.

There is one type of apparatus that deserves special consideration. It is perhaps the most compact and efficient unit that has yet been developed as a portable outfit. It contains all the necessary radiographic accessories and is simple in construction and operation. The parts are the same as the unit first described, though separately disposed and to be assembled for usage. The Coolidge  $x$ -ray tube supplied

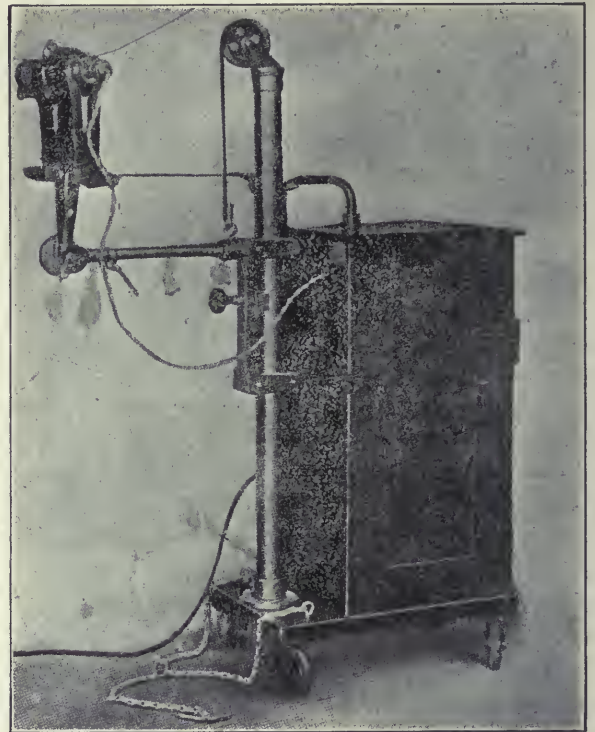


Fig. 1. Portable unit, army type.

with this outfit is of a special type. It is blown of thick glass, with a very high content of lead, 55% by weight, which gives the protection afforded by 1-16 of an inch metallic lead.

The golf bag, containing the tube stand is first opened. The tube stand is removed. The suit case containing the accessories is then opened and the foot screwed to the tube stand. The cross bar is then removed from the front of the suit case and placed in its proper position on the tube stand. The top of the transformer is unscrewed and the transformer placed on the foot plate of the tube stand, with the side marked "right" to the right. The two reels are then removed and placed on the side of the cross arm. The tube holder is removed from the suit case and



screwed to the tube stand. The Coolidge tube which is contained in the rear compartment of the suit case, is placed in the tube holder with the anode to the left, the cathode to the right. The radiator is then screwed on to the anode side but not too tightly. The hook of the reel is attached to the opening in the radiator. The end of the other reel is fastened to the cathode side of the tube. The cable wires contained in the left hand compartment of the suit case are then removed and, if we are dealing with alternating current, the connection is made to the 110-volt lamp socket, then to the three openings in the box containing the switch board. Another connection is made from the other three openings in the switchboard to the transformer. Additional electrodes are attached to the two spherical balls on the transformer to the two reels.

If we are dealing with a direct current the connection is made to the 110-volt socket, then to the direct current side of the rotary converter. Another connection is made from the a. c. side of the rotary converter to the three holes in the switchboard box. Then a connection is made from the switchboard box to the transformer. (Fig. 2.)

To operate, turn on the switch from the socket, then turn on the button marked circuit breaker, and a red light will appear, showing that the connections have been properly made. When operating on alternating current, 10 milliamperes at 100 volts is desired. Push the button on the lower right hand corner of the switchboard to start current and filament and note reading on the milliamperè and volt meters. If the reading is not as desired, voltage may be either increased or diminished by turning the handle marked "volts". Filament current may be increased or diminished by removing the meshed metal cap on the right hand reel and then moving the metal rod either forward or backward to obtain the desired number of milliamperes. There is an attached time switch which has a range to thirty seconds.

#### METHODS OF ROENTGEN EXAMINATION OF FRACTURES.

##### 1. Transillumination—roentgenoscopy.

###### (a) General.

##### 2. Photographic method—roentgenography.

###### (a) General examination.

Single plate target—plate distance, 20 inches

Centric

or

Excentric

###### (b) Special examination.

(1) Stereoroentgenography — two plates made with deviation of tube  $2\frac{1}{2}$  inches, the relation of plate to part remaining unchanged.

##### 1. Roentgenoscopy (fluoroscopy).

The plate examination is comparatively far more complicated than the fluoroscopic method and requires numerous accessory appliances and, though it has the advantage of permanency and greater accuracy of its records, nevertheless, the simplicity, convenience and rapidity in obtaining results make the fluoroscope an instrument of greater general utility.

The requisites of safe and successful fluoroscopy are: 1, a ray of proper quantity and quality; 2, a screen of proper quality, size and suspension; 3, the proper sensitization of the eye; 4, the protection from deleterious effects. Careful attention to the first three requisites will contribute in a large measure to the establishment of the fourth.

The old fluoroscopic viewing box consisted of a small screen attached to a pyramidal hood of cardboard, the eyes being applied to the smaller end, so that the examination can be made in a lighted room. This has come into vogue again because of military needs. Such a pyramidal fluoroscopic screen has been described by Dessani. It is to be fitted to the wearer's eyes and kept in position by bands across the head. By a hinged arrangement the fluoroscope may be tilted back out of the line of vision. When so used, the observer looks through a layer of ruby or green glass, which permits operative procedure without desensitizing the eyes.

Too great emphasis cannot be laid on the problem of protection, particularly when using the portable equipment in which the tube is not very carefully covered. The roentgen ray is an agent capable of causing considerable damage to the organism. Though this appears to be generally appreciated, it is nevertheless surprising to note the utter disregard of this danger during fluoroscopy, particularly with the use of the Coolidge tube, when many of the limitations which gave a certain margin of safety when the Crookes tube was used, do not exist. Carelessness in providing suitable protective measures is bound, sooner or later, to lead to disastrous results. It must not be forgotten that the late skin effects may, and usually do, come on from four to seven years after prolonged exposure. Immunity from such effects for a year or two instils a false sense of security. Eternal vigilance is the price of an intact skin. Such additional protective devices as lead-rubber gloves are essential and ordinary leather gloves



should be worn underneath the rubber gloves. This is particularly important if fluoroscopy be used for the reposition of the fragments. Lead glass goggles and leaded aprons are useful in further increasing the safety of fluoroscopy.

Besides these dangers from the ray itself, there are other hazards which must be guarded against from the installation itself. There seems to be a notion prevalent that because these portable apparatus are small, they are harmless. But this is a serious error. The apparatus is capable of delivering 60,000 volts at 10 milliamperes, and under certain circumstances may cause serious damage and even fatalities if the body comes into contact with the discharges. Because these machines are coming into common usage and are in the hands of those not specifically trained, a word of warning is perhaps in place.

It is important that all metal parts of the outfit, such as the switchboard, table, tube stand and particularly the tube box and handles controlling the movements and diaphragm, should be effectually grounded. For this purpose a flexible cable is preferable to a rigid wire, which may break or become disconnected. Wooden floors are safer than concrete for the operator. Concrete should be covered with some suitable material, such as rubber, wood, thick linoleum.

When operating  $x$ -ray tubes, there should be no loose or slack wires; all connections should be taut and kept so by a spring and whenever possible heavily insulated wires should be used, but even those should always be treated with the same precaution as a bare wire, because the insulation for high tension current is rarely perfect.

All connecting wires of the high tension apparatus must be out of easy reach and so guarded that assistants or patients cannot come in contact with them. These wires should be examined from time to time, and precaution should be taken so that a live wire cannot fall on the patient or operator.

It is good to plan to eliminate all overhead wiring in hospital wards or the small  $x$ -ray rooms. But when such a trolley system must be used, all wires leading from the high tension apparatus to the overhead lines must be periodically examined.

Great care should be taken that all fuses carry only the maximum current required by the apparatus, so that any overload or earth leakage will immediately blow the fuse. Too much dependence should not, however, be placed on these, for they will often carry an overload before blowing.

Care should be taken that the metal extremities of

the tube be not too close to the patient. All metal applicators should also be grounded. Sand bags are best for checking the involuntary movement of patients.

An arrangement that allows of two pieces of apparatus to be simultaneously connected to one high tension source should be avoided. The absence of a commutating device makes the bedside apparatus noiseless, therefore the high tension wires should never be touched without first shutting off the current. When examining and testing an installation it is not enough to merely shut off the main switch on the apparatus, but it is also important to open the switch at the main supply.

The apparatus should not be installed in a room too small or in a narrow space between beds. It may become dangerous to move about.

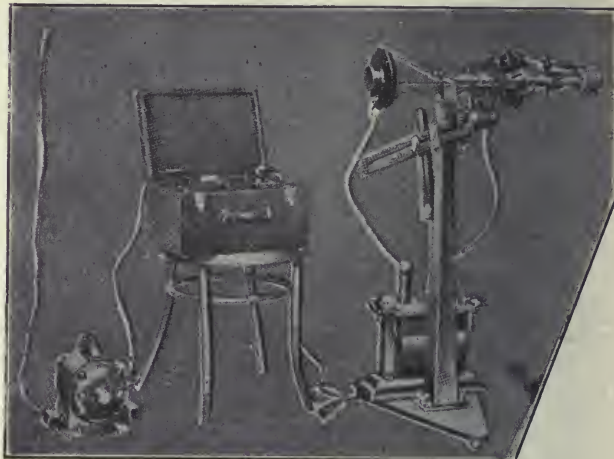


Fig. 2. Bedside arrangement of Coolidge portable radiographic unit for direct current. For alternating current the rotary converter, on the left, is not needed.

If possible, there should always be an assistant about, who is familiar with the position of the main switch.

The quality of the tube should be of sufficiently high vacuum to permit a clear differentiation between bone cortex and medulla. What should be sought for is detail with sufficient contrast. Should it be necessary to move in and out of the fluoroscopic room, colored glasses should be worn. The observer should remain in partial darkness for at least ten minutes before the first examination is begun. The visible light from the tube itself must be eliminated. The static glow of the wires carrying the high tension may be eliminated by the use of a tin or iron piping or heavily covered cable. This holds only when the open screen is used.

The foot switch should be placed in a convenient



situation and permit the control, not only of the energization of the x-ray tube, but the general lighting of the room.

It is a foolhardy and useless procedure to fluoroscope a patient over a long period of time. The energizing of the tube must be intermittent:—a glance and then an interval for orientation and thought; then another period for observations, followed by a period of darkness, for consideration as to what is observed and what is to be sought or still to be determined. By this method the interest of the patient is safeguarded and prolonged exposure is avoided.

Working with a gas tube, whose equivalent spark gap value is six to seven inches, or with a Coolidge tube of five to six inches, and using two to five milliamperes of current, through one millimeter of aluminum, an exposure of ten minutes is the limit of safety at the usual target-skin distance, if a skin reaction is to be avoided. With the constant moving of the body of the patient, incidental to the examination in all directions, no part should, therefore, ever receive a large fraction of a dose.

The disadvantages of fluoroscopy are:

1. The overlooking of fissures and fractures where there is no displacement of fragments or fractures of carpus or tarsus.

2. Exaggeration of deformity by distortion of shadows.

3. Damages of exposure.

4. In operative work, the dangers of explosion from the ignition of the anesthetic by electric spark.

When patients are either too sick to be moved or even turned upon their side or else, by reason of being splinted or slung in Balkan frames they can not be moved, they may be fluoroscoped directly in bed by the use of four stilts, which, when placed under the legs of the bed, raise it twelve inches; the tube can be dropped beneath the bed and fluoroscoping through the mattress secures very satisfactory information. The bed springs of the regulation bed do not interfere materially with the study because, being some distance from the screen and a greater distance from the screen than the tissues to be examined, the mesh casts a much exaggerated shadow, which does not interfere with visualization of the part.

By the method even the sickest patient may be examined without the position of the fractured limb being disturbed. Where the Balkan frame is used, the frame, which is lashed to the bed, is lifted with the bed and rests with the legs of the bed on the stilts.

The commonest errors arise from the following causes:

1. When the parts are incapable of immobilization.

2. When the affected parts cannot be placed in close apposition to the plate.

These errors may be avoided by a careful attention to technique. The immobilization of the part is important because the movement may so blur the bony outline as to make it impossible to definitely determine the fracture line, particularly where long exposure must be used as with the portable unit. This is particularly so in the determination of fractures of the skull in children or in fracture of the ribs or about the shoulder joints.

When immobilization is impossible, rapid exposures must be resorted to by the adjuvant means of a double intensifying screen and a film. Everything which makes for the comfortable position of the examined limb aids in immobilization. This may be accomplished not only by weights, sand bags, bandages, adhesive plaster, pads, and inflated rubber bags, but also by certain positions of the body by which the affected part is put at rest with the muscles relaxed and made to approximate the plate as closely as possible. Any portion of the forearm or arm to be examined properly must be placed at the level of the shoulder. For the examination of the leg it is necessary that the thigh muscles be relaxed. Frequently exposures must be made with parts in suspension apparatus and in such a position as makes approximation of part to plate impossible. To minimize distortion where approximation of plate to part cannot be obtained, the distance from tube to plate should be increased.

3. When there exist no changes in form and outline of the bone nor any displacement of fragments.

In the examination of fractures there are two considerations: (a) to determine the presence of a fracture; (b) to determine the degree of deformity. These two conditions cannot always be met with the same examination, since it is frequently necessary purposely to distort the outlines of the bones in order to determine the presence of a fracture. This gives an exaggerated and false picture of the deformity. The latter condition should be judged by a normal exposure. Thus spiral supramalleolar fractures of the lower end of the fibula even with slight displacement of fragments will be frequently overlooked in the normal antero-posterior or lateral exposures. An oblique view, however, gives the entire length of the malleolus and displays such a fracture prominently.



Thus the scaphoid must be placed with its longaxis parallel to the recording surface by ulnar deflection of carpus and abduction of the thumb, if fractures of this bone are always to be discovered.

4. When the examination cannot be made, or is made only with difficulty, in more than one direction. To study deformity in undisputed cases of fracture under these circumstances, consideration must be given to the relative sharpness of the fragments at the point of fracture, bearing in mind the axiom that the nearer to the recording surface an object is, the sharper and truer its shadow. Thus, in antero-posterior sagittal views, the sharper fragment is the one which is displaced posteriorly. This determination often becomes necessary in fractures about the upper end of the femur or humerus. The stereoscopic examination is here of great assistance.

5. When the fracture is in that axis of the bone that makes the examination in a plane perpendicular to the axis of the bone impossible.

These errors may be avoided also by a stereoscopic examination, which is particularly valuable about the joints, to study the direction and extent of fissures and to seek the important information, which is not always easy to obtain, if the fissure extends into the joint. Frequently, however, fissures parallel to the axis of the bone will escape detection and when clinical evidence is strong, it is advisable to wait two or three weeks and then the callus, at the suspected point, makes the diagnosis clear.

Indirect evidence is often valuable as indicating fractures. With a history of trauma, if the shadow of the fifth lumbar vertebra has a marked obliquity or cannot be outlined at all, a fracture should be suspected. Fractures of the articular processes of the vertebrae may be suspected when the malposition of the bodies exists as shown by a change in the alignment of the spinous processes. If, in a suspected case, both the transverse processes of one vertebrae are narrowed and its axis deviates from that of the vertebrae above and below, one must suspect a fracture of the body of the vertebrae. A fracture of the pelvis may be suspected from the hip plate by a study of the lower end of the sacro-iliac synchondrosis. The sacrum, like the keystone of an arch, registers any break in the arch by a slipping and consequent distortion of the sacro-iliac joint space, the lower part of which should show a normal hip exposure.

6. When the fractures are multiplex and at extreme ends of associated bones, as the upper end of the fibula and lower end of the tibia.

The error of overlooking one of several fractures

may frequently be placed at the door of the clinician whose cursory and unsatisfactory clinical examination confines the *x*-ray examination to a certain part of the limb. This is particularly true in hospitals and laboratories where a localization of the lesion is requested in order to facilitate the examination. The roentgenologist, however, has certain findings which warn him that other fractures should be looked for: for instance, a fracture of the tibia low down with marked displacement of fragments usually is associated with a fracture of the fibula high up. The fracture of the lower end of the ulna usually is associated with a fracture of the radius. A fracture of the pubes usually is associated with a fracture of the ilium. A fracture of the os calcis frequently is accompanied by a fracture of the internal malleolus of the tibia or of the metatarsal bones. In injuries about the wrist, scrutinize the lower end of the radius, the styloid process of the ulna, the base of the first metacarpal and carpal scaphoid.

7. When the fracture lines are mistaken for artifacts, soft tissue folds (axillary and anal) calcifications of bursæ or tendons, epiphyseal lines, epiphyseal scars, supernumerary bones, the os trigonum being mistaken for fracture through the posterior process of the astragalus, os peroneum for cuboid fracture, os vesalianum for fracture of the base of the fifth metatarsal and os triangularis for fracture of the styloid process of the ulna. Sesamoids may be mistaken for fragments of a fracture and pulmonary markings for fractures of the ribs, the line of the psoas or fracture of the transverse processes of the vertebræ.

8. When the examinations are made through heavy casts or heavy board splints. Under these circumstances the exposure should be doubled without a change in the quality of the ray. Subperiosteal fractures and callus formation about complete fractures are frequently undeterminable when heavy casts have been applied, particularly so if the casts are wet.

9. By looking and not seeing. This is easily remedied by a slow and careful perusal of the entire bone length and by a refusal to be rushed into the diagnosis of a wet or dirty plate. Make as studious a contemplation of the plate as the surgeon does of the patient.

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It is a wise rule to inspect the patient's hand within 12 hours after applying splints or plaster cast to the arm or, especially, the forearm. If these are, or become, too tight an irreparable Volkmann's contracture may be produced within 24 hours.



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, MAY, 1921

### FRACTURES.

It would not be difficult to trace the various factors that have stimulated to its present pitch the surgeon's interest in the treatment of fractures. Some of these come to mind at once: the routine employment of roentgenography, the important work of Sir Arbuthnot Lane, the valuable contribution of Lucas-Championnière, the increasing attention of the medical profession and of the State to industrial accidents and to the functional restoration of the injured, the reports of the Fracture Committees of the American Surgical and the British Medical Associations and—by no means least—the intensive study, during the war, of the management of fractures as they occurred with "gunshot" wounds.

It was because of the unsatisfactory results that often followed various methods of splinting, especially in fractures of the humerus, the femur and the tibia, that Lane easily evoked an enthusiasm for the operative treatment not merely of ununited and mal-united fractures, but also for recent, simple fractures. We believe that this enthusiasm has waned, not only because plates, clamps and screws are foreign bodies that often delay union and produce other troubles, but because we have learned other, less risky, methods by which, in most cases, good position can be secured and maintained. Open reduction will

continue as a necessary procedure in many cases, but these are the exceptions and not the rule.

The perfect reposition of bone fragments is a mathematical ideal, not a surgical necessity. The objects to be sought in the treatment of a fracture are: the contacting of the broken ends; "adequate" reduction, i. e., without shortening or without material shortening; the avoidance of angulation, of axial rotation and of injury to soft parts; the preservation or early restoration of function. All of these objects can be attained, in most cases, without converting, by open operation, a simple into a compound fracture.

The plaster of Paris cast is perhaps the most useful immobilizing means for fractures in general. We have learned, nevertheless, that it is not usually satisfactory in fractures of the shaft of the femur; however well reduced, e. g., on a Hawley table, overriding of the fragments is apt to recur despite a plaster cast. In fracture of the humerus, too, the cast or moulded splint, without continued traction, is usually insufficient. By adequate traction, however, overriding can be overcome, gradually or at once, in many femur cases completely, in most cases within an inch; while by proper direction of pull, and the proper position of the limb in a suspension support, angulation and rotation are controlled under the eye.

The revival and elaboration of the traction-suspension treatment of fractures of the thigh and the leg came about in the war through the necessity of exposing for dressings the large wounds by which these injuries were compounded. But the beneficence of this mode of treatment in simple fractures also became evident. The application and development of the method to fractures of the humerus was the work of Col. Blake, who has reviewed the principles and the technic of his procedures in this issue of the JOURNAL. The application of traction-suspension in fractures of the tibia is described in the excellent article by Moorhead; and its indications in the management of intertrochanteric fractures are presented in Kellogg Speed's elaborate study of that subject.

One of the advantages of traction-suspension treatment is that it can be arranged to maintain mobility of the joints. Blake has emphasized this in connection with the use of the method in fractures of the humerus. In fractures of the femur the knee may be left free, either from the outset (by employing the Steinmann nail, the caliper tongs or the Hennequin loop) or after a few weeks, by replacing the adhesive strips with a Hennequin loop above the joint or applying the strips to the thigh only. Most



surgeons, we believe, are of the opinion that prolonged immobilization of a joint stiffens it and greatly retards restoration of function. Dr. H. Winnett Orr, on the other hand, believes that complete immobilization is preservative of joint function. We invited him, therefore, to submit his arguments in this issue of the JOURNAL, and we present them to our readers for their consideration.

After applying a plaster cast to a fractured thigh or upper arm the surgeon has nothing to do until the time arrives for its removal—when he can take note, all too late, of its shortcomings. The traction-suspension treatment is not so easy; it requires much attention throughout, and especially the first week. The surgeon who has not the inclination (indeed, the enthusiasm), and the time, to “fuss over” its details, and to control his results by frequent bedside roentgenography (not only until he has secured the best attainable position but also from at intervals thereafter), had better turn the case over to a surgeon who has.

Major fractures involving the ankle joint are among the most difficult to manage. Unless they receive optimum treatment, Pott's and similar fractures or, more properly, fracture-dislocations of the ankle, are often crippling. We commend the careful study of the contributions on this subject by Estes and by Cotton, members of the Fracture Committee of the American Surgical Association. Both articles are excellent. Than Cotton's one would have to look far, indeed, to find one more clear and concise, more straight-to-the point concerning diagnosis and treatment.

Fractures about the elbow are also apt to interfere with joint function. In this connection one thinks especially of fractures through the ends of the humerus or the ulna. But fractures of the upper end of the radius, sometimes not recognized, may also prove crippling. They are not as fully described in the text-books as other injuries to the elbow; and so we are very glad to present here the excellent detailed study of Hitzrot. His classification of upper radius injuries is very interesting, the more so since it affords a basis for treatment and for prognosis.

We do not mean to refer to all the contributions in this special issue of the JOURNAL. Written by experts, for the purpose, and upon assigned topics, they are all admirable. To be sure, they do not cover all the fractures to which the human skeleton is subject, but they do deal with the most important fracture-groups; and they present very clearly the principles in treatment, the choice of methods. We believe we have reason to be proud of this issue of

the JOURNAL. We believe, too, that it will be read through with interest and profit, and preserved for future reference.

## Fracture Suggestions

Extensive, early ecchymosis after a trauma is very suggestive of a fracture.

Localized tenderness after a trauma is also suggestive of a fracture.

After an injury to the head take note of the occlusion of the teeth, with the jaws closed naturally, and with the upper and lower incisors brought into line. A deviation, even slight, of the line between the lower central incisors to one side of the line between the upper central incisors, suggests the possibility of a fracture of the mandible, and it may be the only sign that the patient then exhibits. However, a slight deviation is habitual with some individuals.

Subcutaneous emphysema of the chest, with fracture of a rib, means, of course, that the lung has been lacerated or punctured. It is important to determine then, by physical signs and roentgenography, whether there is also an accumulation of blood in the pleural cavity. Unless such a hemothorax be small in amount, it is usually advisable to evacuate the blood with a large needle or small trocar, after allowing sufficient time for hemorrhage to cease.

Fracture-dislocation of the upper cervical vertebrae without injury to the spinal cord is not rare. In such cases attempts at reduction involve grave risk of producing what the patient has thus far escaped. It is wiser to let well enough alone.

After an injury to the back, persistent pain in the lumbar region, or root pains elsewhere in the body, may be due to a fracture of a vertebra undiagnosed at the outset and undemonstrated by roentgenogram.

A congenital cleft in one or more of the lumbar or sacral vertebral arches is not uncommonly seen in roentgenograms. Such a cleft is occasionally oblique, narrow and unilateral. It should not be mistaken for a fracture.

In old people pain and disability in the arm after a trauma call for a careful examination of the shoulder. Fracture of the head of the humerus is often overlooked.



In cases of fracture of the anatomical neck of the humerus, examine carefully for injuries to the brachial plexus.

Fracture of the greater tuberosity of the humerus is usually followed by a long period of shoulder disability if the injury is treated by fixing the arm in an adducted position. It should be treated in *abduction*. This is most simply and most comfortably accomplished with the patient in bed—continuously or intermittently—the arm abducted on pillows and supported by a sling from the elbow to the head of the bed. After about three weeks light Indian club exercises are useful to secure full and free movements at the shoulder.

Fracture of the head or either neck of the humerus is also best treated by abduction in bed, with such rotation of the arm as will secure the best axial alignment. Fixation in plaster is not necessary. Indeed, it will result in more disability than treatment without such immobilization.

When a child who has been pulled by the arm has disability in that member, attention should first be directed to the upper end of the radius. There will probably be found a subluxation of the head of the bone ("pulled arm") or an epiphyseal separation. The "pulled arm" often jumps into position during examination, and the disability at once ceases.

It is wholly wrong to treat a Colles' fracture by continuous immobilization of the forearm and hand for several weeks. After reduction there is little tendency to displacement. Light, supporting, molded splints are sufficient. The fingers and thumb should not be splinted or bandaged; their free movement should be encouraged from the outset. Before the end of the second week the splints should be removed every day or two for massage and passive movements of the wrist. In the third week the dorsal splint can usually be dispensed with, and the palmar splint shortened sufficiently to permit wrist movement. Indeed, in many cases of Colles' fracture Moore's adhesive plaster support-sling is all the retentive appliance that is necessary. The chief factors in securing a good result in Colles' fracture are, first, reduction and, second, preservation of wrist function by massage and exercises.

Fracture of the anterior superior spine of the ilium occurs occasionally, especially in adolescents,

as the result of sudden muscular violence—as in springing forward from a crouching position in a foot-race.

Simple inspection is sufficient to make a diagnosis of fracture of the neck of the femur. Shortening of the extremity, elevation of the trochanter and external rotation of the foot are eloquent signs. Manipulation adds nothing except pain!

Fracture of the base of the fifth metatarsal is not a rare accident, as the result of twisting the foot in walking or dancing. The lesion is often mistaken for an ankle or tarsal sprain.

## Progress in Surgery

Selections from Recent Fracture Literature.

H. Lyons Hunt, M.D., L.R.C.S., Abstract Editor

**A British Medical Association Lecture on The Influence of the War on the Modern Treatment of Fractures.** HENRY WADE, Edinburgh, *The British Medical Journal*, March 5, 1921.

The author calls attention to the fact that a fracture during the war was a matter of team work, the regimental medical officer being the family doctor of his battalion. His duties were also those of an instructor imparting to units of his regiment information relative to first aid. The duties of the regimental medical officer were to cover the wound to prevent it being further contaminated, to relieve pain, to arrest hemorrhage, to provide rapid and comfortable transport and to minimize shock.

In cases of fracture of the femur, the first splint consisted usually in the application of a rifle to the side of the thigh to immobilize it. Later the Thomas splint was applied. This splint had a number of advantages. It sufficed for the transport of cases not only of fracture of the femur, but in injuries of the lower extremities. The simplest and best bed-frame in the author's experience is the Morison R. I. E. bed-frame.

**Fracture Reduction and Fixation with a Specially Designed Band.** ASA W. COLLINS, San Francisco. *Archives of Surgery*, March, 1921.

In historical review of this subject, the author shows that the early Egyptians used splints and employed open operations. Treatment by the open method is preferable in certain types of fracture associated with comminution such as fracture of long bones, fracture associated with wide separation of the fragments by muscular pull of the interposition of soft parts.

The mortality of the operative method of reduction is so small that this cannot be used as an objection to the method and in cases where there is no objection to the open method of operation, the operator must decide on the best method, plate, wire band or bone graft.

After briefly considering the physiology of bone and the repair of fracture, Collins deduces that the essential consideration in selecting a procedure, is to consider the effect of the bone splint or band on the periosteum and its function in repair.

Believing that the Lane plate was fundamentally wrong, the author devised a band which would not encircle the bone at any one point in the circumference, but would give perfect



apposition of fragments without any foreign body being introduced into the bone substance proper.

His objection to plates is that they cover a large surface of periosteum, are bulky and depend for results on screws driven into the cortex. The screws frequently become loosened, and as a result the plate's grasp is weakened, infection ultimately developing.

The objection to the Parham band, bands devised by Milne, Lambotte and Rexwald Brown, is that to a greater or less degree, they constrict periosteum as also does wiring.

The band devised by the author is placed on the bone with a special applicator. He gives results of experimental studies on 75 rabbits which warranted him using the band on the human subject, and from case reports gathered to date, including more than 100 fractures, the humerus and femur have been operated on in all but 7 cases, the band removed in 8 cases, 4 of these because the operator objected to allowing any foreign material to remain in the tissues, infection occurring in 5 cases, each being a compound fracture.

The author concludes:

1. The band is more quickly applied than screw plates, bone grafts, kangaroo tendons, medullary dowels, etc.
2. It furnishes sufficient force under easy control to bring the parts into apposition and is of sufficiently strong mechanical construction to immobilize them.
3. It provides a simple means for fastening without disarranging the tension or position of the band or the fragments.
4. Through its use, a circle of unyielding pressure at any one point is avoided; and the band adapts itself to an uneven flaring surface.
5. The band is compatible with a good callus formation.
6. It has no deleterious effect on growing bone, but on the contrary, it stimulates growing bone. (Further experiments to establish just why this should occur are now in progress).
7. And lastly, it affords greater satisfaction to the operator even in those cases in which normal function might be assured with a lesser degree of coaptation, especially in cases related to accident insurance, the Workmens' Compensation Act, damage suits, etc.

#### A Concept of X-Ray Pathology. Fractures. A. J. PACINI, Washington. *Medical Record*, March 19, 1921.

For purposes of x-ray pathology, the author divides fractures into those of flat bones and those of long bones. The flat bone fractures involve the skull and vertebra. He classifies fractures of the skull in the usual manner and states that linear fractures occasion a radiopaque line if both tables are involved, a radiolucent line if only one table is involved and must be differentiated from suture lines, diploic vessels and arterial grooves.

Depressed fractures may be bounded by radiopaque margins. On account of basal fractures being frequently overlooked, he advises that vertical projection of the base in addition to an anteroposterior, posteroanterior, sinistrodextral and dextrosinistral views, should be taken in each case.

Vertebral fractures are recognized in x-ray pathology by the deformity produced in the body of the vertebra. Pathology involving the fifth lumbar vertebra should be expressed with caution. He divides fractures of the long bones into those affecting the diaphysis and those affecting the epiphysis.

The author decries the fact that callus formation does not appear to receive the amount of attention that it should. In children in diaphyseal fractures it appears about the tenth day; in adults calcium salts being deposited usually at the end of three weeks, while in old people the same change does not commence until six weeks.

In freshly sustained fractures the roentgenologist should report not only in terms of the anatomical part affected, of the variety of the line of fracture, of the direction of the upper and lower fragment and of the presence and absence of overlapping, but he should take such views of the fractured part as are necessary in establishing definitely the disturbed balance of muscle group pull responsible for the deformity, with the view to guiding the surgeon in the correct alignment of the part of traction for obtaining the zero position in the correction of the injury sustained.

#### Fractures of the Base of the Radius (Colles' Fractures).

ROSCOE C. WEBB, Minneapolis. *Minnesota Medicine*, March, 1921.

In the history of this fracture, the author draws attention to the fact that previous to 1783 it was considered as a dislocation and was first described as a fracture by Pouteau in that year. His views were denied recognition as were those of Colles in 1814 until 1830. The writer calls attention to Hitzrot's explanation of this fracture into three types: "A" type follows the line of ossification between the diaphysis and epiphysis and is about 1.75 to 2.25 cm. above the radio styloid. "B" type has the line of fracture entering the radio-ulnar joint. "C" type is 3.75 cm. or more above the radial styloid and is found in young people. (*AMERICAN JOURNAL OF SURGERY*, February, 1921.)

Reduction in anesthesia is important. Waiting for swelling to subside before reduction is poor therapy.

In conclusion the author states: Colles' connection with this fracture is purely of historical interest, and the substitution of the term fracture of the base of the radius will promote progress in study and treatment.

The fractures result from a combination of compression and extension and vary with the manner of falling and age of the patient.

These fractures should be considered as emergency cases and reduced at once under anesthesia.

The surgeon should interpret the x-ray plate himself and treat each case as indicated.

Deformity and impairment of function depend upon:

- (a) The character of the line of fracture
- (b) The age of the patient
- (c) The time of reduction
- (d) The character of reduction
- (e) After-treatment.

#### Delayed Union and Non-Union of The Radius and Ulna. H. W. MEYERDING, Rochester, Minn., *Minnesota Medicine*, April 25, 1921.

While the failures of some fractures to unite may be due to faulty reduction and incomplete fixation, the interposition of periosteal structures, necrosis, loss of bone substance and impaired blood and nerve supply, there is a group in which neither syphilis nor any of the foregoing factors appear, but in which the process of ossification ceases before union is complete.

Fifty-nine patients with delayed union or non-union were observed in the Mayo Clinic from May, 1913, to June, 1920; the average length of time since fracture was more than fifteen months.

Meyerding describes in detail with illustrations a bone grafting operation favoring massive graft held by beef-bone screws and external fixation by plaster casts. The splints should be maintained until roentgenographic evidence proves that strong osseous tissue has formed and then the graft should be subjected to careful increasing use so that it may grow in size and strength equal to the strain required for function.

Meyerding reporting five cases with illustrations, concludes:

1. The massive bone transplant has given the most satisfactory results and may be held firmly by means of beef-bone screws.
2. The flat internal surface of the tibia supplies a graft of almost any required size and shape, and with medullary bone rich in osteoblasts allows a wide approximation which insures early union.
3. Fixation by a plaster of Paris cast from the fingers to the mid-humerus is a satisfactory method.
4. Fixation should be maintained until firm union and a strong bridge of bone are demonstrated.
5. The arm should be used gradually on removal of fixation, as the graft fractures when it is subjected to sudden and too great stress.
6. Fractured grafts may reunite when given further fixation.



### The Hodgen Splint in Fractures of the Femur—Technic of its Application. F. E. CLOUGH, Lead, S. D. *The Journal-Lancet*, March 15, 1921.

Having used the Hodgen splint for forty years at the Homestake Mining Company's hospital at Lead, S. D., with uniform success, Clough describes in detail its proper application and installation.

The splint consists of two principles, extension and suspension. The first is secured by a Buck's adhesive plaster or flannel strips applied with glue. If adhesive plaster is used, the leg should be shaved. If glue is used no shaving should be done. When applying Buck's adhesive three-inch plaster is split into three tails as far as the ankle and applied very carefully to the leg and thigh. Two or three strips of adhesive are then wrapped corkscrew fashion around the leg and the whole covered with muslin bandage. Advise is given to rub the strips smooth, allowing them to remain for a few minutes without any pull, in order to become firmly adherent. To prevent the strips pressing into the malleoli, a spreader board about four inches long is placed in the adhesive plaster as it goes around the foot. When not using adhesive, Heusser's glue, composed of:

resin—50 parts,  
alcohol—50 parts  
(pure) benzine—25 parts  
Venice turpentine—5 parts

is substituted. The strips, regardless of where the fracture is located in the femur go at least five inches above the knee or higher if the fracture is above that point.

A cradle is next made of strips of bed-ticking, ranging in width from three to five inches fastened onto each side of the frame of the Hodgen swing, and while supporting the frame with a bridle, the strips are pinned to conform to the contour of the leg and thigh. The cradle should extend from the crotch almost to the ankle. The foot of the bed is next elevated six inches and the loop of the Buck's extension as it goes around the foot is securely fastened to the bottom of the frame with two pieces of muslin bandage. From a ceiling hook placed eighteen inches beyond the foot of the bed, there is dropped a pulley rope equipped with a tent-block which is fastened to the rope bridle of the swing. This produces more or less extension according to where it is tied to the swing. Failure of successfully handling such fractures is due to lack of attention to keep the foot at a right angle with the leg and a right-angled wire foot-piece with a bandage covering is fastened to the frame.

The reader is cautioned against changing dressings too often in handling fractures.

The swing should be utilized six to sixteen weeks, depending upon the location of the fracture. Those of the neck of the femur require the longer time. The walking Thomas splint is recommended for convalescent cases. The writer gives morphine during the first few days of treatment and advises that the fractures should be checked up at regular intervals with x-ray findings.

### Fracture of the Femur; A Simple Method of Extension.

B. F. PENDRED, Loughton, Essex. *British Medical Journal*. March 12th, 1921.

Pendred advocates a method for fracture above the middle where the upper fragments is flexed forwards. In such cases the patient is placed in bed, on his back, the head and shoulders being supported by two or three pillows. The knee of the injured limb is raised until the femur is at the required angle which is generally about thirty to forty degrees to the horizon. It is maintained in this position with a knee pillow, or better still by a pyramid of sand-bags. A ring-shaped air-cushion is slipped over the foot drawn up to the knee and inflated as fully as possible, the foot being allowed to fall back on the bed. A strong bandage is tied around the air-cushion exactly opposite the knee and the other end carried to a pole or mast fitted to the foot of the bed; strong traction is made in the line of the upper fragment, lower fragment, diameter of cushion, bandage and point on mast, until the ring becomes definitely oval, when the bandage is fixed to the mast.

The advantages of this method are:

1. Simple apparatus. A few pillows, a long piece of stick, a bandage and a ring air-cushion or inner tube of a motor tire. Such things can be obtained almost anywhere at very short notice and there is no need to keep apparatus of various sizes in stock.
2. Ease of application. No skilled assistance required.
3. Once fixed adjustment is seldom required. The bed-clothes are arranged so that the ring cushion is uncovered and visible, a glance at its shape informs one immediately of the degree of tension and inflation.
4. The foot, hanging over pneumatic pad, acts as a kind of rudder and prevents rotation of the lower fragment, or if desired, it can be pushed inwards or outwards, rotating the lower fragment in any required direction.
5. There being no pulleys, guy-ropes, weights or iron frame, there is very little necessity for disturbing the patient, which saves much anxiety and suffering. A bed slipper is easily adjusted.
6. The thigh is supported underneath by sand-bags, and others may be used at the sides if required to give a sense of security, but these are not necessary. The thigh can therefore be fully exposed, permitting easy examination, dressing and massage of suitable type, all without any disturbance of the fragments whatever.

### Compression Fracture of the First Lumbar Vertebra With Delayed Symptoms (Kuemmel's Disease).

RUDOLPH V. GORSCH, New York City. *Annals of Surgery*, March, 1921.

Gorsch reports a case of a male aged fifty-six who three months before coming under his care sustained an injury of the back. Roentgenograms were taken which revealed no fracture. Two months later pains recurred in severe form, and accompanied by numbness along the lower border of the ribs; and a "hump" was noticed at the site of the injury. The examination revealed in the lumbar region of the spine a distinct kyphos. Indistinct vertebral spine, limited motion, tenderness on deep pressure and a roentgenogram showed crushing fracture of the first lumbar vertebral body.

The case was reported on account of the failure to make an early diagnosis with the aid of roentgenograms.

The author concludes that the reason for this is the lack of marked persistent sensory or motor symptoms referable to cord injury and the patient's general condition being good.

### Bone Grafts in the Repair of Defects of the Skull.

(*Reparation des Breches Craniennes par les Greffes Osseuses. Comparaison avec les Greffes Cartilagineuses et avec l'Endoprothese*). P. MAUCLAIRE, Paris. *Paris Medical*, February 19, 1921.

The various methods of repair used in cases of skull wounds are classified as follows by the author:

#### I Living Bone

- a. From the neighborhood—periosteal, cutaneo-periosteal, osteo-periosteal
  1. With or without a pedicle
  2. Autoplastic, homoplastic, heteroplastic
- b. From a distance (tibia, etc.)

#### II Dead Bone (macerated, decalcified, carbonized calcinized, sterilized—homo- or heteroplastic)

The indication is always loss of bone substance without underlying cerebral lesion, the best results being obtained where this indication was fully met. For small defects, osteo-periosteal grafts taken from the neighborhood or from the tibia gave the best results. For large defects, broad pedunculated bone-diploë from the neighborhood gave the best results. Ivory or other endoprothesis may be of value with a small gap. Closing the wound has a markedly favorable effect psychically as well as objectively.

### Recurring Dislocation of Shoulder Joint. JAMES WARREN SEVER, Boston. *The Journal of the American Medical Association*, April 2, 1921.

The deltoid and coracobrachialis will hold the head of the humerus in place if given a chance; and by removing the



pull of the stronger pectoralis major and taking up the slack in the stretched subscapularis, one can be assured of a permanent cure. The complete division of the pectoralis major, then, should be practiced in all cases without subsequent suture as well as definite shortening of the tendon of the subscapularis. These two procedures are essential. Repair of other torn or stretched tendons, such as the supraspinatus and infraspinatus, may also be made, but are not as necessary. Capsulorrhaphy may also be performed in conjunction with these two primary steps, but is not an essential to success. Complete division of the pectoralis major has been done by Sever in about forty cases with no untoward results. The arm can be adducted quite as well as before, and no essential loss of function has been observed.

**Irreducible Dislocations of the Foot.** (*Deux Cas de Luxations irreductibles du pied*) M. WIART, Paris. *La Presse Medicale*, February 19, 1921.

The first case, a subastragaloid dislocation of the first degree according to Baumgartner—Hugeuer's classification, was apparently irreducible. The author performed an arthrotomy and then made an easy reduction. He believes that this method can almost always give reduction where other means fail, and that astragalectomy, formerly considered the method of choice, does not conserve function and has limited indications.

The second case was one of luxation of the internal planar medio-tarsal joint. Here again reduction was impossible, and the author opened the space of Chopart and succeeded in replacing in good position the scaphoid and cuboid. But the reduction was not maintained so that several periarticular sutures had to be taken. After three weeks immobilization, the patient was up and around bearing full weight on the foot, with an excellent functional result. This type of dislocation is very rare.

**Researches on Bone Grafts** (*Recherches sur les Greffes Osseuses*). L. CHRISTOPHE, Liege. *La Presse Medicale*, March 12, 1921.

The author confirms the experimental work of Nageotte and Sencert in regard to the regeneration of grafts of dead tissue, using bone boiled for sterilization and preserved in alcohol, instead of the soft tissues they used—arteries, nerves, and tendons. Using this bone as grafts experimentally on rabbits and dogs, he found that in certain favorable cases, the bone showed definite evidences of regeneration and union with the adjacent living tissue so that on microscopy dead and living bone were not distinguishable. In less favorable cases this was not observed, however, even after a period of five and one-half months. Four pictures of sections illustrating the growth of this dead bone are shown. The author is following this work up, and intends to give full details and results in a later article.

**Air Injection Into Joints and the Derangements of the Semilunar Cartilages** (*Le Syndrome Meniscal et la Pneumoseuse Articulaire*). J. TERRACOL and L. J. COLANERI, Metz. *La Presse Medicale*, February 9, 1921.

The authors believe that insufflation of joints for radioscopic purposes at last offers the only certain means of diagnosing internal derangements of the knee. Using Bennet's classification of derangements of the semilunar cartilages, the authors experimentally produced similar pictures on the cadaver, followed by air injection and radiography.

After these experiments and after some practical experiences with some cases in which the diagnosis was checked by surgical intervention, the authors are certain that insufflation facilitates the study and differential diagnosis of the anatomico-physiological lesions composing the meniscal syndrome, especially the more frequent dislocation of the meniscus which has a characteristic picture in the radiogram which they compare to a "coup d'onde". It permits verification of clinical data and also aids in establishing the diagnosis. It is of great interest also for further investigation of exact localization for therapeutic purposes.

## Book Reviews

**Orthopedic Surgery.** By ROYAL WHITMAN, M.D., M.R.C.S., Eng., F.A.C.S., Associate Surgeon to the Hospital for Ruptured and Crippled, New York; Orthopedic Surgeon to the Hospital of St. John's Guild; Consulting Orthopedic Surgeon to St. Agnes' Hospital for Crippled and Atypical Children, White Plains, etc. *Sixth Edition*. Royal Octavo; 914 pages; 767 illustrations. Philadelphia and New York: LEA & FEBIGER, 1920.

The sixth edition of this standard work differs from the fifth chiefly in the expansion of the chapter on Military Orthopedic (including Reconstruction) Surgery from 12 to 55 pages. This has been accomplished without materially enlarging the book, by a condensation of 30 pages in the rest of the text. Whitman lays stress on diagnosis and on the prevention of deformity, which makes his work a particularly valuable one as a guide for the general practitioner and the general surgeon.

**A Manual of Surgery for Students and Physicians.** By FRANCIS T. STEWART, M.D., Formerly Professor of Clinical Surgery, Jefferson Medical College; Surgeon to the Pennsylvania Hospital. *Fifth Edition*. Royal Octavo; 1086 pages; 590 illustrations. Philadelphia: P. BLAKISTON'S SON & Co, 1921.

This is a posthumous edition, the manuscript for which, almost finished by the author, was completed and prepared for publication by Dr. Walter Estell Lee. There are many changes and considerable amplification. As might be expected, these are found in the sections on infection and disinfection, shock, transfusion, fractures, amputations, and plastic operations. There is also much new matter in the sections dealing with the bones, the joints, the chest, the nerves, the rectum and the urinary tract. Much of the chapter on surgery of the abdomen has been rewritten.

The work is essentially a manual for the student and for the medical practitioner.

**Traumatic Surgery.** By JOHN J. MOORHEAD, B.S., M.D., F.A.C.S., Late Lt.-Col., Medical Corps, American Expeditionary Forces; Professor of Surgery and Director, Department of Traumatic Surgery, New York Post-Graduate Medical School and Hospital; Visiting Surgeon to Harlem Hospital; Attending Surgeon, Park Hospital; Consulting Surgeon, All Souls' Hospital (Morristown, N. J.); Lt.-Colonel, Medical Reserve Corps, U. S. Army. *Second Edition*. Royal Octavo; 864 pages; 619 illustrations. Philadelphia and London: W. B. SAUNDERS COMPANY, 1921.

Moorhead's work is a valuable contribution to the literature of a subject in which the surgical profession has recently manifested a much quickened enthusiasm, one in which the industries in general and the community at large are deeply interested.

The first edition appeared just before we entered the World War. Since then the author's very large experience in traumatic surgery has been greatly augmented by active service in base- and advanced-hospitals in France. This has been brought to bear in the preparation of the second edition, which is fully representative of those methods, developed during the war, that are equally useful in the treatment of injuries in civil life. The work has thus been expanded by about 100 pages, and enriched by about the same number of illustrations. There has also been added a chapter on Standardized First-Aid Treatment.

In extended critique of the first edition (*The JOURNAL*, October, 1917) we called attention to its many good features and criticised its faults of omission and of commission. Some of these are again apparent in the second edition. Skin-grafting is not adequately discussed for a work of this character. Hydrocele (scrotal) scarcely belongs in such a book for trauma is "the rarest of all causes", as Moorhead himself says. Traumatic hydrocele usually subsides spontaneously, and for the non-traumatic variety neither Jabou-



lays' operation nor Andrews', which, beside aspiration, are the only ones described, is the best. Concerning the first edition we said "He includes a reference to subacromial bursitis quite properly since this affection is probably traumatic in origin. His too-brief description and his indications for treatment are, however, quite misleading. He reproduces here the illustrations from Brickner's articles on this subject, but he has mislabeled them altogether, in effect misquoting this author". The reviewer is pained to find that in the second edition this section is reproduced without any correction. Nevertheless the reviewer recognizes in this work, especially in its now more comprehensive form, an excellent and practical exposition of traumatic surgery; and he recommends the book not merely to general practitioners but also to those experienced in surgery.

**History and Bibliography of Anatomic Illustrations,** in its Relation to Anatomic Science and the Graphic Arts. By LUDWIG CHOULANT. Translated and edited with notes and a biography by MORTIMER FRANK, B.S., M.D., Secretary, The Society of Medical History, Chicago. With a biographical sketch of the translator and two additional sections by FIELDING H. GARRISON, M.D., and EDWARD C. STREETER, M.D. Royal Octavo; 422 pages; illustrated. Chicago; THE UNIVERSITY OF CHICAGO PRESS. (for the Mortimer Frank Memorial Committee) 1920.

This volume is published as a memorial to Dr. Frank who died in 1919 soon after the completion of this edited translation.

Choulant's book is one of the classics of medical literature and stands alone as the only authoritative and comprehensive book of anatomical illustration extant. As only one edition was published in 1852 and as copies of this book are scarce, students of anatomic illustration will welcome Dr. Frank's translation. Frank, however, did more than a mere translation. By comparing this book with an original copy of Choulant, of which the reviewer is a proud possessor, one can see what immense labor Frank must have expended in bringing forth this work. The text has been amplified considerably; references to which Choulant had no access have been inserted and the whole has been brought thoroughly up to date. Indeed, to all intents and purposes this is a new book, only the nucleus of which is Choulant's famous work. All the original illustrations have been carefully reproduced and a large number of new ones added.

Garrison has contributed much to the charm and value of this book. In addition to a short sketch of Dr. Frank's career, he adds two chapters: one (with Dr. Streeter) on "Sculpture and Painting as Modes of Anatomical Illustration" and the second on "Anatomical Illustration since the Time of Choulant". Both are written with all this distinguished author's scholarlyness and grace of style. This book is one of the noteworthy contributions to historical medical literature and will serve as an invaluable reference for many years to come. Any medical library will be graced by its presence.

Theophrastus Bombastus von Hohenheim, called **Paracelsus**. His Personality and Influence as Physician, Chemist, Reformer. By JOHN MAXSON STILLMAN, Professor of Chemistry Emeritus, University of California. Octavo; 184 pages, illustrated. London and Chicago: THE OPEN COURT PUBLISHING CO., 1920.

Paracelsus is one of the romantic figures in medicine. Although his life and works have been subjected to extensive historical research and criticism, it is difficult to gain a fair perspective of his influence upon medicine. By some he is regarded as little more than a charlatan, by others his influence is supposed to have been enormous. Unquestionably Paracelsus was a most picturesque character; a combination of charlatan, braggard, tramp, mystic blackguard, fighter; and yet withal an ironoclast, a doctor well versed in medical lore and possessed of unusual common sense, a chemist with knowledge far in advance of his time, and a man of absolutely fearless and independent mind. In an age when orthodoxy was the rule, he smashed traditions right and left, disagreed with the formulas of Galenic doctrine and fought with reckless abandon the views of his contemporaries. He erected a system of medicine of his own that was

a remarkable combination of mysticism and shrewd insight. Amidst the immense rubbish of his writings, one finds some remarkable pronouncements and extraordinary intuitions. He was a pioneer in chemistry and helped greatly to release it from alchemy. He repeatedly insisted on the power of nature to heal disease; he dimly grasped the principle of asepsis; he realized the necessity of fighting the cause of disease rather than its symptoms, he conceived disease as a disharmony of normal functions, and he added many new facts to the nosology of various diseases.

Dr. Stillman has given us an excellent account of this extraordinary person; it is based largely upon the study of Paracelsus' genuine writings and upon the monumental researches of Sudhoff. His account has enabled us to gain a better perspective of the life of Paracelsus than that we have been enabled to obtain from any other source. The book has afforded us many moments of real pleasure.

**Doederlein- Kroenig Operative Gynaekologie. IV Auflage.** Bearbeitet von Dr. med. et Dr. art. obs. h. c. ALBERT DOEDERLEIN, Geheimer Hofrat, O. O. Professor der Geburtshilfe und Gynaekologie; Direktor der Universitäts-Frauenklinik, München. Imp. Octavo; 1023 seiten; 455 teils farbigen abbildungen und 15 farbigen tafeln. Leipzig: GEORG THIEME, 1921.

This volume has always been considered an authoritative exposition of the state of operative gynecology and abdominal surgery in Germany and Austria. A new edition after an interval of nearly nine years, is therefore well worthy of careful scrutiny.

Krönig, of Freiburg, one of the previous co-editors, died recently. Therefore the whole task of revision (except in the chapter dealing with anesthesia, where a young man, Zweifel, has helped) has fallen to Döderlein.

The new edition is larger by 74 pages and 26 illustrations than the previous one. The excellence of the illustrations is maintained.

Spinal (lumbar) anesthesia is still highly recommended and constantly employed. Statistics now embrace 42,754 cases with 47 deaths, or one death in 910 cases. To avoid accidents, only gold or platinum trocars are used, stovain is preferred, not more than 4 ccm. of fluid is injected (this includes the spinal fluid withdrawn), the specific gravity of the solution must be high, and the patient is kept in the sitting position for four minutes.

Extradural (para-sacral), parametrial and para-vertebral anesthesia are used by some. Local anesthesia is recommended solely for the repair of fresh perineal tears. Its use in laparotomy is inadvisable in most cases, post-operative pneumonia being increased where it is employed.

The floor drains of a modern operating room should be connected with the outlet of the sterilizers so that after each operation the water in the syphon traps is sterilized by the escaping steam. Thus no accumulation of septic matter can occur.

Phyostigmin is no longer used post-operatively. Döderlein waits until flatus is passed before attempting to move the bowels.

No new methods for treating infection of the abdominal wound are mentioned.

Thrombosis and embolism can be reduced by not tying the legs when operating in the Trendelenburg position (use shoulder braces), by scrupulous hemostasis, by early graduated exercise in bed, and by giving heart stimulants for ten days after operation.

Among other operations for retroflexion of the uterus, Baldy's procedure is still recommended.

Hysterectomy is strongly condemned in the treatment of prolapse. The primary results are not lasting and the resulting enterocele can be cured only by complete obliteration of the vagina. The operations for cystocele have not been brought up to date by Döderlein.

The author has not much good to say for the interposition operation. He prefers the Schauta technic in which the uterus is covered by vaginal mucosa, to the method of Wertheim. As high a percentage of recurrences as 50, may be expected. A few operators are beginning to use fascial



transplants to help in holding the uterus and in strengthening the perineal floor.

After tying or resecting the tubes to induce sterility 6 per cent. of failures may be expected.

No change in the ultra-conservative treatment of genital and peritoneal tuberculosis appears.

Döderlein recommends immediate laparotomy in tubal pregnancy. He does not temporize in shock. In doubtful cases exploratory posterior colpotomy should be performed.

In patients over 40 years of age raying of fibroids is to be preferred to operation. Sarcoma is not a contraindication. On the contrary, the results here are far superior to operation. Corporeal cancer can be excluded by exploratory curettage.

The permanent (5 years) results with radium equal the operative cures although the radium cases were more advanced.

No changes in the operative technic for cancer of the cervix is recorded. Operation for recurrences are successful in only a small percentage of cases but this must be regarded as pure gain.

The closure of inguinal and femoral hernial sacs from within the abdomen is mentioned.

In intestinal surgery silk alone is used.

The advances in gastric surgery are not adequately discussed.

An undue amount of space and a wealth of new illustrations are accorded to the new operations (Sneguireff, Schubert, Strassmann) for forming a vagina by utilizing the rectum. The same criticism may be made of the description of Stoeckel's operation for establishing urinary continence by using the pyramidales muscles.

The recommendation for treatment of rectal prolapse is still limited to sigmoidopexy—which is not adequate.

No mention is made of fulguration in the treatment of bladder papillomata.

Hebosteotomy is still lauded.

Extraperitoneal Cesarean section is preferred to the transperitoneal operation.

These short abstracts give but a slight idea of the wealth of material dealt with. The volume, as before, is a monumental production, clear, concise, explicit—a safe and sane guide and a valuable councilor. It does, however, fail in showing many of the advances made, and is not as complete a revision as could be hoped for. For example, the time has arrived for again taking stock of the indications and prognosis for ovariectomy. Döderlein still uses the statistics of Pfannenstiel, etc., dating mainly from 1905. The reviewer had hoped that the wealth of material accumulated by the German clinics in the last 15 years would be sifted and presented to the profession.

**The Sympathetic Nervous System in Disease.** By W. LANGDON BROWN, M.A., M.D., (Cantab.), F.R.C.P. (Lond.) Physician with charge of Outpatients, St. Bartholomew's Hospital; Physician to the Metropolitan Hospital, etc. Duodecimo; 147 pages; 9 illustrations. London: HENRY FROWDE, HODDER & STOUGHTON, 1920.

An expansion of the Croonian lectures of 1918 has resulted in a most valuable volume dealing with the autonomic nervous system.

The interrelations of the involuntary nervous system to disease states are discussed only in relation to the endocrine glands, glycosuria, digestive disturbances, circulatory difficulties and vagotonia.

An introductory chapter is devoted to the plan of the autonomic nervous system, while a concluding section deals with the responses.

The needs for and the benefits of stimulation of the sympathetic and antagonistic parasympathetic systems in the struggle for existence are carefully presented and adequately serve as a preliminary basis for appreciating the functions of the unconscious mind. The value of the katabolic activities under control of the sympathetic system is briefly stressed with reference to the work of Cannon and Crile, but the surgeon will find more advantage in an understanding of the origin of local zones of hyperesthesia practically presented by Head.

The chapter dealing with the endocrine glands is logically developed, unusually clear and convincing, and reflects the complex but intimate interdependence of sympathetic function and endocrine activity in the interest of "the preservation of the individual and the continuity of the species." The adrenals, thyroid, and pituitary glands are considered in their relation to the autonomic nervous system.

The relation of the mind and emotions to the organic functions of the body is interpreted in terms of physiology and vital processes—beyond the control of the will, instead of in the terminology of the present day insistent psychologist.

**The Croonian Lectures on The Psychology of the Special Senses and Their Functional Disorders.** Delivered before the Royal College of Physicians in June 1920. By ARTHUR F. HURST, M.A., M.D. Oxon, F.R.C.P., Physician and Neurologist to Guy's Hospital. Octavo; 123 pages; illustrated. London: HENRY FROWDE, HODDER & STOUGHTON, 1920.

The Croonian Lectures, enriched by illustrative cases, present the views of the author on hysteria in its various manifestations. Its importance as an expression of symptoms induced by suggestion and curable by psychotherapy is not to be forgotten in connection with injuries of all types.

The frequency of hysterical states following surgical conditions suggests the value of familiarity with the simple problems as developed by the author in a convincing and satisfying manner.

**Teeth and Health.** How to Lengthen Life and Increase Happiness by Proper Care. By THOMAS J. RYAN, D.D.S. and EDWIN F. BOWERS, M.D. Duodecimo; 254 pages. New York and London: G. P. PUTNAM'S SONS. THE KNICKERBOCKER PRESS, 1921.

A popular disquisition on the importance of teeth as related to human health and happiness, written in the style of the medical columnist.

## Books Received

**Surgery.** Its Principles and Practice. By various Authors. Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Emeritus Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. Volume VII. Royal Octavo; 855 pages; 359 illustrations. Philadelphia and London: W. B. SAUNDERS COMPANY, 1921.

**On Bone Formation,** Its Relation to Tension and Pressure. By Dr. MURK JANSEN, O.B.E., Lecturer on Orthopedic Surgery, University of Leiden (Holland). Royal Octavo; 114 pages; illustrated. Manchester: THE UNIVERSITY PRESS. London, New York, Bombay, etc.: LONGMANS, GREEN & Co., 1920.

**Operative Gynecology.** By HARRY STURGEON CROSSEN, M.D., F.A.C.S., Associate in Gynecology, Washington University Medical School, and Associate Gynecologist to the Barnes Hospital; Gynecologist to St. Luke's Hospital, St. Louis Maternity Hospital, and Bethesda Hospital; Fellow of the American Gynecological Society and of the American Association of Obstetricians and Gynecologists. Second Edition. Royal Octavo; 717 pages; 834 illustrations. St. Louis: C. V. MOSBY COMPANY, 1920.

**Clinical Surgery By Case Histories.** By ARTHUR E. HERTZLER, M.D., PH.D., F.A.C.S., Professor of Surgery in the University of Kansas; Surgeon to the Halstead Hospital, Halstead, Kansas, and to St. Luke's and to St. Mary's Hospitals, Kansas City, Mo. Volume I. Head, Neck, Thorax, and Extremities. Volume II. Diseases of the Abdominal and Genitourinary Organs. Royal Octavo; 1106 pages; 483 illustrations. St. Louis: C. V. MOSBY COMPANY, 1921.



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## PLASTIC AND COSMETIC SURGERY OF THE HEAD, NECK AND FACE.

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and

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NEW YORK CITY.

### HISTORICAL REVIEW.

The history of plastic and cosmetic surgery is largely the history of surgery itself. As blood-letting was, in the middle ages, in the hands of the barber, so one of that worthy craft, Pfolsprundt, antedated, as an author and practioner, by several hundred years, the more scientific Tagliacozzi.

Surgery is usually regarded as a modern science, yet the ancient Hindoos, perhaps two thousand years ago, performed many difficult operations as successfully as we perform them now. Particularly is this true of some forms of plastic surgery and skin-grafting. It was the custom in India to punish certain officers by cutting off the nose. Consequently there appeared at an early date men skilled in plastic surgery, who belonged, strangely enough, to a low and despised class, the tile maker's caste. Their work is said to have been excellent, even superior in some respects to that done at the present time. One of the most remarkable achievements of these pioneers in surgery was the replacement of the nose by a graft from the thick skin of the gluteal region, a feat which even now cannot be repeated with certainty. When we consider that the subcutaneous fat was included and that no support could have been had from underlying tissues, the success obtained seems little less than marvelous. The temptation is great to ascribe some virtue to the secret "cement" employed, but we know so little of the actual technique that speculation in this line is not of much value.

It was once thought that pieces of skin transplanted from one individual to another grew vigorously or withered as the original possessor's health became good or bad. Hence, it may be imagined that the man bearing such a graft must often have been very solicitous as to the physical welfare of the donor. It is probable that skin grafting, like some other arts, was largely lost sight of doing in the middle ages; but occasional accounts of isolated cases have been

preserved. It is related by Sancassani (1731-1738) that a female street vendor, in order to prove the efficacy of a certain salve, was accustomed to cut a piece of skin from her leg, pass it around the audience on a plate, and then replace it in its original position, covering it with the salve. Such perfect union took place that the site of the operation was hardly discernible.

About the eighteenth century some accounts of the Indian methods of grafting were brought to Europe by travellers. The statements, however, were credited by few, and those who did believe were generally disappointed when they tried to experiment themselves.

In the middle ages surgeons were craftsmen and received no learned degrees, either in Germany or in other countries. In Germany the treatment of all external diseases was in the hands of the surgeons or *wundaerzte*, barber surgeons. To this class of practioners belonged Heinrich von Pfolsprundt, who lived about the middle of the fifteenth century. A work entitled "*Buch der Buendth-Aertznei*"—which means directions for bandaging—attracts our attention, not only because it was the first surgical treatise written in German, but on account of its contents.

Had this volume, which was composed in 1460, thus antedating that of Hieronymus Brunschwig by thirty-seven years, become known when it was written, history would have accorded Pfolsprundt the honor of being the first author to describe the Italian operation of rhinoplasty to which the name of Tagliacozzi has been attached ever since the latter furnished a description of it one hundred and twenty-six years after this German work was written.

Concerning Pfolsprundt's technique in plastic surgery, the author says: He describes how to perform only two bloody operations, namely, for hare-lip, and for restoring a lost nose. His directions for operating on hare-lip are simple and to the point. The armamentarium consists of a sharp knife or scissors, wherewith to freshen the edges some distance from the margin, and if necessary the wound is made larger in order to secure the accurate approximation of the wound surfaces, which are held together by sutures; and if a suture is inserted on the inner side, the union becomes still more accurate.



From the historical standpoint the description of rhinoplasty forms the most important chapter of the book because it is the first description of the procedure concerning which neither Branca, the inventor, nor his son Antonio, who modified it, nor any contemporary, has written.

Branca, a surgeon living in Catama, Sicily, during the first half of the fifteenth century, was undoubtedly the first to restore noses that had been lost by traumatism. He took the flap either from the forehead or from the cheek, for "*ex ore*" might mean either. Antonio, the son, formed the nose out of the skin of the upper arm and added cheilo- and otolplastic work. Whether Branca *invented* the procedure or whether he learned of the performances of the physicians of East India, who practiced rhinoplasty from the remotest times, is a question the discussion of which has produced literature of no mean proportions.

Pfolsprundt's description of the operation is as follows: First a model of the proposed nose is made of parchment or leather, the same size as the lost member. This model is laid upon that part of the upper arm which, by raising, and approximating the arm to the face has been found to be the most suitable, and then the outlines of the model are traced upon the skin with ink or some other coloring material. The portion of the skin thus marked is separated with a sharp knife from above downward, so that the lower portion which will serve as a bridge or pedicle, extends the width of two fingers beyond the lines of the model. This portion of the skin is not severed; it remains attached. Then the arm is brought up over the head and the flap is united with the surface of the nose by sutures, and the arm and head immobilized by means of bandages. On the eighth or tenth day after union has occurred, the pedicle is severed in such a manner as to furnish a flap of sufficient size to unite it with the upper lip and to furnish the two nasal openings. The skin is properly trimmed, and by freshening the upper lip the pedicle is attached to it. Two quills covered with wax are then inserted into the nasal openings. The nose is moulded into proper shape by pressure made with appropriately weighted small bags. The comfort of the patient is greatly conserved by making the flap sufficiently long.

After cicatrization of a wound, following the loss of the nose, Pfolsprundt advises converting the scar into a fresh wound. His method is that of Antonio Branca, who first advised using the skin of the arm. Who taught our author this method, he divulges only

in so far as he tells us he learned it from a Walen, i. e., a Welshman—an Italian, who had helped many people and had earned much money by it.

In delving into the history of plastic surgery, the name of Gaspard Tagliacozzi is frequently and intimately associated with rhinoplasty. He was born in Bologna in 1546 and occupied the Chair of Anatomy and Surgery in the University of Bologna for thirty years. His only work was published in 1597 at Venice. He gives credit to no one devising the operation of restoring the nose, but says the process of grafting trees inspired the idea and contends there is no part of the body better fitted to replace the lost part than the skin of the arm.

He considers the possibility of obtaining the flap for restoration of the lost nose from another person, but says this is not always successful because it is impossible for two persons to be fastened immobile for so long a time as is required. He maintains that his method of operating is free from all danger to a non-cachectic patient. He describes what he calls the different degrees of mutilation, and the difficulties of restoring the lost part. He discusses the preparation of the patient, the instruments, the patient's clothing, his assistants and the operation itself. In order to render the part from which he obtained his flap more mobile, he pulled upon the skin over the biceps several times with his fingers, then caught the skin between a large flat fenestrated pincers, plunged a bistoury through their fenestrae, and cut the skin through the part exposed by the fenestrae. He then passed a bandage through the wound, carefully raised the pincers, and daily drew the bandage as a seton through it. When this bridge of tissue became strong and firm enough, through the employment of reporcussion, antiphlogistics, astringents, etc., and all symptoms of irritation had subsided, which usually occurred about the fifteenth day, he cut through the upper part of the bridge of tissue. The flap was then turned over and the wound treated. "They say," Tagliacozzi remarks, "that it is better to detach the flap on three sides, as it saves time for and avoids pain to the patient, but the flap retracts too much and easily becomes gangrenous".

When the flap of skin, which he calls "*progago*", had cicatrized, he proceeded to fasten it to the nose. After the patient's head and beard had been shaved he was clad in a shirt, with a hood which fitted him perfectly. The complicated bandage which was to keep the arm and nose in juxtaposition was also put in place ready to be applied. The surgeon then scarified the stump of the nose with a bistoury and sharp



forceps, so as to make an even wounded surface. A piece of paper was cut the same size and form as the facial wound and placed upon the flap which, after its under surface was scraped, was cut according to the paper pattern. Interrupted sutures of waxed thread were then passed through the flap and the stump of the nose, the arm lifted to the nose and the sutures tried—the sutures being farther apart on the stump than on the flap. The bandage was then fastened in place.

When cicatrization had taken place between the flap and the stump, which usually occurred about the twentieth day, Tagliacozzi removed the bandage and cap, and while his assistants held the patient's arm, he cut the flap at its base away from the arm. At the same instant the new nose became white and cold, "but", says he, "this phenomenon need not occasion any uneasiness". While his assistants dressed the arm wound, hot fomentations and a four-tailed bandage were applied to the nose.

About the fifteenth day, when the nose was firmer, he measured the length of one-third of the face which is about the average length of the nose and marked with ink the future tip and the lower borders of the alae and septum. After cutting out an opening in the flap for the nostrils and making a small flap for the lower end of the septum, tents soaked in white of egg were introduced into the nostrils. Cicatrization of the nostrils usually took place anywhere from the twenty-first to the forty-first day, when the operation upon the septum was performed. The stump of the septum and under surface of the flap for the septum were scarified and sewed together with curved needles. The sutures were usually withdrawn on the fourth day.

He placed tubes made of lead, silver or gold in the nostrils, and covered the nose with caps of the same material which could be lined with cloth in winter. The tubes and cap were fastened together and the patient was compelled to wear them for two years, though sometimes permitted to lay them aside during the day or in hot weather. It was considered beneficial to expose the nose to the sun's rays which tended to give it a natural color. Application of turtle-bile was considered the best means of effacing the cicatrices. "It is possible to restore the lips in the same manner", adds Tagliacozzi, "but the flap of integument for the lower lip should be taken from the forearm, and if it is for the ear, it should be taken from behind the ear".

John Baptiste Van Helmont, the Flemish chemist, relates the case of a native of Brussels who had a

new nose made by Tagliacozzi at Bologna from the arm of a street porter, and that he lost it three months after his return to Brussels, at the instant the street porter died at Bologna. "This example", he remarks naively, "proves up to what a distance magnetism and sympathy can act". Samuel Butler alludes to this example of plastic surgery:

"So learned Taliacotius, from  
The brawny part of porter's bum,  
Cut supplemental noses, which  
Would last as long as parent's breech  
But when the date of Nock was out  
Off dropt the sympathetic snout".

It may be seen from the above historical notation that plastic surgery in the 15th century was as abundant in failure as successes, not unlike corresponding results of the 19th century.

As Togliacozzi's name was intimately associated with plastic surgery of the midtimes, so India and Indian surgeons are historically connected with its birth.

The origin of both plastic and cosmetic surgery is of the greatest antiquity, being referred to even in the Ayurveda of the Hindoos.

No mention is made of restoring the loss of a nose by any European or Arabian writer from Galen's time to 1295, when Lanfranc of Milan came to Paris. Lanfranc states: "They tell of the nose being completely detached, the patient carrying it in his hand and that after his nose had been fixed on the wound cicatrization occurred; but this is a signal lie because the spirit which presides over life, nutrition, and motion is instantly removed from that part which is separated from the body". He admits, however, the possibility of restoring by bandages or ligatures a nose that is still partially attached to the face.

Peter Ranzano, Bishop of Lucera, recites the following in the *Annales Mundi* (1442): "At this time there flourished a Sicilian named Branca, the first surgeon of the world, for he had discovered a thing very amazing and unbelievable—the means of repairing the loss of a nose. Gourmelin credits Branca with being able to restore a lost nose by taking the needed material either from the patient's arm or the nose of a slave. Branca's son perfected this operation. This new art probably came to Sicily from the East Indies, and not from the Arabs, as no mention is made of rhinoplasty in their writings. Ranzano declares the elder Branca originated the operation. From Sicily the art passed into Calabria, the adjacent Italian province, where it was practiced by a family named Vianeo, or Bojano. Vincent Vianeo of Maida was probably the first to perform the operation in



Italy. After his death his son Peter and nephew Bernardin continued to do it, and enjoyed such a reputation at Tropea that their work was designated *Magia Tropoeusium*.

In the second decade of the 19th century reports of successful operations by Carpie in England and C. Graefe in Germany aroused the attention of surgeons. Lucas learned frontal rhinoplasty from Indian operators and practiced it successfully before Carpie's book appeared.

Reconstructive surgery was studied first to replace mutilated noses and received impetus from non-medical literature. Ferriar in 1798 published *Illustrations of Sterne with other Essays and Verses* and describes at length an operation of rhinoplasty. About the same time (1794) the *Gentleman's Magazine*, *Pennant's Views of Hindustan* and *Madras Gazette* all gave accounts of new noses constructed to relieve disfigurements so common in India.

Reverden in 1871 proposed skin grafting to cover ulcers and granulating wounds. Hauff also discovered that small pieces of skin would serve as centers of epithelization, and heal ulcers previously considered incurable. Thiersch, in 1886, went further and transplanted large pieces of the upper layers of the skin. Wolfe, a Glasgow surgeon, performed skin grafting without a pedicle, especially to restore eyelids. Hüter even used hairy flaps to repair eyebrows. Ollier showed that raw surfaces of bone would unite.

In perusing the literature of this subject one is struck chiefly with the lack of appreciation of the need for a lining membrane for all mucous membrane cavities. Not until Keegan's time was it given any prominence, and perhaps even he did not appraise it at its full value. And so it is that the various classical methods take their name from the covering flap employed. In actual fact, except that forehead skin most closely resembles nose skin, the origin of the covering is the least important part.

Hoffacker (1828) reported sixteen cases of noses, lips and chins sliced off at Heidelberg duels, that united after reparation. In one case the amputated organ had to be rescued from a dog. Cut off noses in India could be replaced so successfully that, when criminals or enemies were mutilated, the noses were thrown into the fire.

American surgeons took up the practice through Mütter's influence. Roux thought the possibilities endless. By the middle of the 19th century unpierced skin was used for making a new nose. The tissue was usually taken from the buttock of the patient. Bünger apparently was the only European who was

successful with this method. Mütter, destined to fame, about 1837 published in the *American Journal of Medical Sciences* an article on "Cases of Autoplastie", detailing operations on deformities of the mouth and nose. Five years later he published in the same journal "Cases of Deformity from Burns Successfully Treated by Plastic Operations". Joseph Pancoast, of Philadelphia, and J. Mason Warren, of Boston, are also entitled to the credit of introducing reparative surgery into American practise. Their success was ridiculed in many European publications.

As in rhinoplasty, so in the rest of present-day plastic work, the principles laid down by the fathers of surgery are found still to be of general application. There is hardly an operation—hardly a single flap—in use today that was not suggested a hundred or more years ago.

As an age creates a genius, and necessity produces invention, the world war with its grievous injuries again created a demand for constructive surgery, plastic in character and often cosmetic in type. Large hospitals were established in all the warring countries and the work in special institutions was devoted entirely to plastic surgery of the face. Some of the results obtained are only comparable to jewels lost in the sea, for in the stress of work and over-work, little time was found for records. In this brief historical review, therefore, the authors have omitted many names famous in this technical branch of surgery, but they will be referred to in succeeding chapters in connection with their particular labors.

(To be continued)

#### WASSERMANN CONTRADICTIONS.

The Wassermann test and the gonorrhea fixation test should be made by at least three serologists working independently; the serum should be taken simultaneously and sent to the different laboratories under identical conditions; one serologist is not to be depended on, however capable he may be.

Three serologists will agree in approximately fifty-three per cent. of Wassermann tests and approximately forty-two per cent. of gonorrhea fixation tests. That is, the chances are about fifty-three in a hundred that three serologists will agree on any given serum. Curiously enough they are more likely to agree in the negative cases than in the positive cases. Probably the serologists can say why that is so. At all events, it is well to devote more study to the clinical features of our cases and trust not quite so implicitly on our laboratory workers for our diagnosis—ABRAHAM L. WOLBARST in the *New York Medical Journal*.



## SURGICAL DIATHERMY.

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The destruction of tumors by heat is gaining ground. This is especially true of tumors whose bloody extirpation on account of peculiar conditions outweighs in danger the possible benefit, or primarily inoperable tumors, or cases of relapse, the extent of which permits of palliative intervention only, and finally in instances in which experience has proven that primary and remote results obtained by heat are more favorable than after the operation with the knife, as for instance in tumors of the urinary bladder.

Surgical diathermy or electrocoagulation is called the desiccation of structures by the heat produced through the resistance offered by the tissues to high frequency currents sent through them. This method has decided advantages over the application of heat by means of the galvanocautery, the soldering iron or the Paquelin cautery. Electrocoagulation proceeds smoothly without any interruption by cooling off, as in the use of the active cautery, its power field can exactly be determined by gauging its penetration at the choice of the operator. This is made sure of by empirically testing the electrodes in connection with the measuring appliances connected with the diathermic apparatus, permitting of an exact grading of the amperage and voltage brought in force during action. Electrocoagulation produces immediate sealing of the lymphatics and cavernae of the tissues adjacent to the desiccated area, thus preventing any dissemination of tumor cells. This, together with the form of destruction, does away with the danger of producing enteral ulcers, so frequently observed after extensive burning with the active cautery. Electrocoagulation furnishes another advantage by being the best precursor to radiotherapy. While occasionally the exposure of a malignant tumor to therapeutic rays excites uncontrollable luxuriation of the growth, such an untoward effect is never observed after preliminary electrocoagulation.

In order to prevent the conveying of electric shocks the patient and operator are insulated by rubber mats, placed under the body of the patient and underneath the operating table, so that the operator and his assistants stand on this rubber carpet. This is especially important, if one uses a diatherm that is grounded by cable connection with a radiator or waste pipe. All diathermic apparatus are provided with a foot switch, enabling the operator to freely use both hands during the operation.

The active electrodes are gold-plated brass discs of various sizes, to be connected with threading to the handles of vulcanized rubber. These connections place the electrodes either straight or at right angles to the shaft of the handles. For intralaryngeal use the active electrode is fastened to a flexible thick copper wire insulated by rubber tubing.

For the purpose of coagulation the high frequency current is either sent through the tumor by using two active electrodes of equal size, between which the tumor is caught at various angles, or one large indifferent electrode is placed somewhere upon the surface of the body and the small active electrode is brought in contact with the growth in order to coagulate at the area desired. The inert electrode consists



Fig. 1. Coagulation of tongue. (Semi-schematic drawing.)

of a leaden plate, either disc-shaped or quadrangular, having a diameter of twenty centimeters. Its surface, to be placed on the patient's body, is either covered with loofah or with thick layers of gauze, which covering is saturated with salt solution before application. Such an electrode is pliable and may easily be adjusted to any part of the body. It is important to keep the padded surface in intimate contact with the patient's body, to prevent any burning or perforation of the skin by sparks which may occur if this intimate contact is interrupted in spots. The application of surgical diathermy is very painful and therefore will as a rule call for general anesthesia. Only in very superficial lesions and in the larynx local anesthesia may be used to advantage. For electrocoagulation on the head or inside the oral cavity rectal anesthesia is preferable. In this way ignition



of the ether vapors by an occasional spark is avoided and the inconvenience of interrupting the operation during administration of the anesthetic is done away with. For operations inside the mouth, fauces or larynx it is expedient to have the patient in a sitting posture.

In electrocoagulation one always must be careful to avoid the production of sparks, because the intention is to desiccate the tissues and not to burn and comminute them. The appearance of sparks indicates either interruption of the intimate contact of the electrode with the tumor or the employment of too much current; either has to be corrected as soon as discovered.

While operating on the lips or cheeks or the fauces, the teeth and the jaw bone have to be protected by wooden or fiber retractors or hard rubber

dermal aspect of the tumor. The diameter of the electrodes is chosen according to the size of the growth. The coagulation is continued until the whole affected area is transformed into a hard crust.

One should not be afraid, in case of such necessity, to produce large defects in lips or cheek. Coagulation extending into the apparently healthy tissues around the growth is one of the safeguards against relapse. It is remarkable how quickly extensive losses of substance are reduced to insignificant indentations by the drag of the cicatrization, the latter utilizing the mobility of the adjacent covering of the facial skeleton. In case of need a plastic operation may always be resorted to, after the cicatrization is solidified and after proper raying has followed the coagulation.

In carcinoma of the tongue the jaws are kept

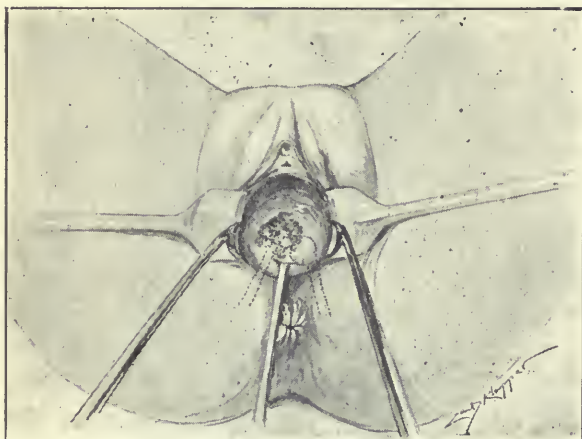


Fig. 2. Coagulation of portio. (Semi-schematic drawing.)

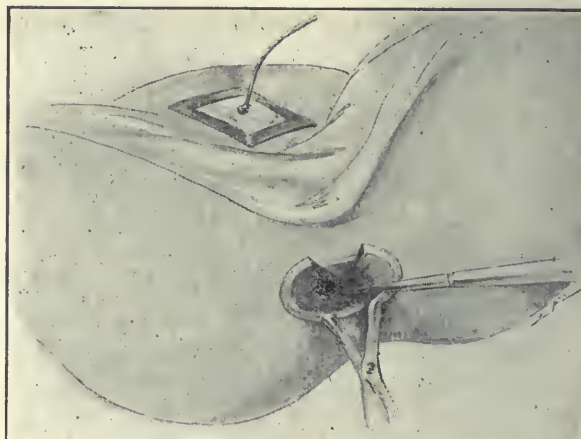


Fig. 3. Coagulation inside of rectal ampulla. (Semi-schematic drawing.)

caps—an omission of this precaution may be followed by loosening and loss of teeth or even by necrosis of the processus alveolaris. The loosening and sloughing off of the diathermic scab requires from eight to sixteen days according to the depth of the coagulation. Underneath the scab there appear healthy granulations. The epithelization of these areas progresses rapidly, especially on mucous surfaces. Occasionally the *restitutio ad integrum* of extensive skin defects has to be supported by Thiersch transplantation.

Epitheliomata of the lips and cancrs of the cheek furnish excellent opportunities for surgical diathermy. After proper protection of the adjacent structures a labial tumor is caught between two active electrodes, placed at right angles to the handles. In the same way cancrs of the cheeks are attended to, one electrode placed against the oral surface of the tumor, the other being pressed against the epi-

apart by an adjustable gag; the tongue near its root is seized by a stout guy thread and pulled forward. Then between two active electrodes the coagulation is accomplished, after which the guy thread is removed. In case the malignant involvement extends to the floor of the mouth, after diathermy of the tongue is accomplished, one changes to the unipolar method. An inert electrode is placed somewhere on the body of the patient and the floor of the mouth is coagulated to the necessary extent with a stencil-shaped active electrode. In malignant tumors of the fauces the electrocoagulation is accomplished again by the unipolar method. Although, as a rule, there is not much reaction, in extensive tumors a tracheotomy may precede the diathermy in order to prevent the fatal consequences of an edema of the epiglottis. The canula is removed and the tracheal wound permitted to heal, as soon as the scab begins to loosen. The palliative results of this interference are very



satisfactory. By reducing the tumor or tumors to a crust, breathing and swallowing are again made easy; the patients and their surroundings are no longer annoyed by the pestilential exhalations of the decaying growth, and the general condition improves rapidly. If necessary, the whole procedure may be repeated. During the period of sloughing the fauces and oral cavity are regularly irrigated with a mild solution of permanganate of potash. In intraoral tumors electrocoagulation is of prime importance for the application of therapeutic rays. It is just in tumors in this location, in which so often a stimulation by the therapeutic rays is observed, if they were applied without previous desiccation.

Extensive cancrroids of the skin of the neck, which become particularly vicious when they invade the scalp, resist as a rule any therapy except electrocoagulation. Pfaelzer has called attention to the favorable

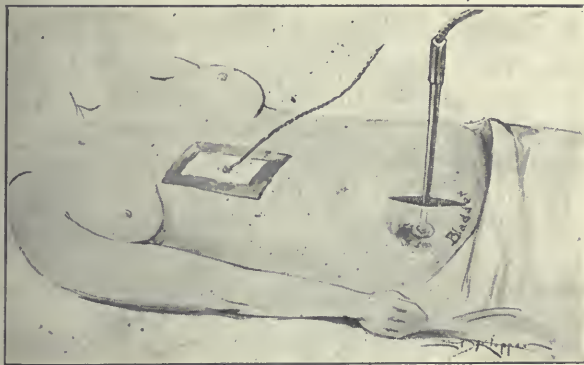


Fig. 4. Monopolar coagulation of bladder tumor. (Semi-schematic drawing.)

results that obtain in these afflictions through the combination of diathermy and  $x$ -ray therapy. In these instances electrocoagulation is executed at best in this way: an inert electrode is placed on the patient's body and an active electrode is used a stencil-shaped electrode carrying a rather large disc. This active electrode is used like a flatiron, coagulating the entire pathologic area of such an ulcer rodens. This is followed by intense raying. Occasionally suspicious irregular granulations will crop out again in some spots; immediately after their discovery they are again submitted to diathermy.

The mode of applying diathermy to the cancer of the portio vaginalis cervicis depends on how much is left of the cervical cone and whether it is still possible to dislocate the uterus downward. Both these items are ascertained after the cervix is cleared by the insertion of fiber retractors in the vagina. If conditions permit, the cervix is seized by vulsella and pulled downward. After the usual encircling incision

the bladder is pushed upward as far as possible and held in this position by a trowel-shaped retractor. This is done with the Douglas attachment. The portio is now caught in turn in its antero-posterior and frontal diameters between two active angular electrodes and thoroughly coagulated. If the portio is replaced by a carcinomatous crater monopolar diathermy is employed, the crater, parametrial and vaginal infiltrations being included in the coagulation. In either case radiotherapy follows this intervention.

Cancers of the rectum, either inoperable when discovered or inoperable relapses after operation, offer good opportunities for palliative relief by diathermy.

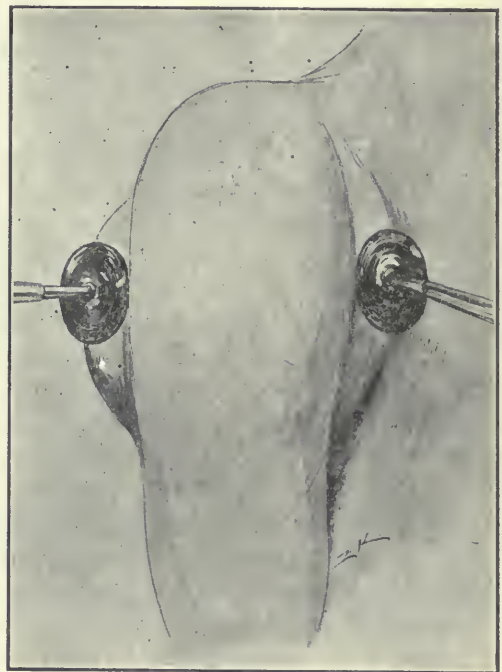


Fig. 5. Coagulation of axillary glandular tumor. (Semi-schematic drawing.)

The ampulla is opened and the tumor exposed by the insertion of a three-bladed speculum. Then by monopolar application of the current the mass within reach is thoroughly coagulated. In some instances after the reaction has passed other carcinomatous regions come into view and are handled in the same way. Relief is furnished in various directions. The pain, hemorrhage and offensive discharge are immediately stopped and the mechanical obstruction is done away with. By the combination of electrocoagulation and radiotherapy symptomatic results are obtained that in a good many instances may persist for quite a long period. In cases of vesical tumors if diathermy within the opened bladder is decided upon, whether the bipolar or monopolar mode of electrocoagulation



is applied, will depend upon the character of the tumor and upon the available space, both items to be decided after the interior of the bladder is exposed by suprapubic cystotomy and insertion of the non-conducting retractors. Previously to the operation a Barnes bag is inserted into the rectum in men, into the vagina in women, and distended by the injection of 200 cc. of water. This serves to elevate the base of the bladder and to make this area of the viscus readily accessible. Incidentally it may be mentioned that this rubber bag emanates a characteristic odor when heated to a degree that is not yet deleterious to the tissues—if during the process of electrocoagulation this odor is perceived, it has to be taken as a sign that the action of the current is approaching the vesico-vaginal or vesico-rectal septum and further penetration may lead to a perforation and the formation of a fistula.

If a tumor presents a well-defined pedicle and a bushy, dendritic crown, this latter part is first superficially coagulated by the monopolar method. This prevents hemorrhage and the dissemination of tumor cells during the handling of the growth. Then the top of the tumor is seized with a fenestrated forceps and lifted upward. In order to avoid changing of the electrodes, the stretched pedicle is severed with a galvanocautery close to its base. Then the stump and the surrounding area are coagulated by the stencil electrode. If a tumor has a rather massive pedicle or if a sessile tumor stands out in relief, protruding into the vesical cavity, then the whole procedure will be shortened if the pedicle or the prominent part of the sessile tumor is coagulated by the bipolar method. This, of course, is possible only in case sufficient space is available for the application of two opposite active electrodes. After coagulating the pedicle or the protruding part of the tumor the base again is treated with the stencil-shaped electrode. If lack of room excludes the use of two electrodes or if an infiltrating tumor is the operative object, the whole tumor mass and its base are coagulated by the monopolar method. If the coagulation has to extend over a small area only, the bladder may be completely sewed up after the coagulation is finished. Spontaneous urination and occasional flushings suffice for the removal of the slough. In extensive cases the usual suprapubic syphonage is employed. In either instance the electrocoagulation is followed by placing radium or mesothorium in the bladder.

Prostatic cancers fall within the realm of surgical diathermy if the mechanical obstruction and hemorrhages cannot be controlled by radiotherapy or if the intracapsular tension due to rapid growth of the

tumor causes unbearable pain. The prostatic protrusion is exposed by suprapubic cystotomy and after proper clearance with non-conducting retractors is coagulated by the monopolar method. Then suprapubic syphonage is established. After removal of the drainage tube radiotherapy is applied through the abdominal fistula. The percentage of good palliative results is favorable.

It remains to mention three cases in which electric diathermy furnished symptomatic relief, after all other means had failed. All three were glandular relapses in the axilla following the attempt at cleaning out the lymphatics in the axilla incidental to the so-called radical operation for cancer of the breast. The interference with the circulation produced enormous swelling of the arm and hand, while the involvement of the nerve plexus caused excruciating pains, which even huge doses of opiates failed to relieve in the slightest degree. As a last resort the axillary tumors were coagulated between two very large active electrodes. While, of course, no cure was expected or accomplished, the suffering of the patients was relieved to such an extent that moderate enjoyment of life was again made possible, and restful nights were restored.

#### SOME PHASES OF LEG ULCER\*

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The subject here considered is an old and familiar one, perhaps even a tiresome one; yet the last word upon it has not been uttered. Certainly chronic leg ulcers are rather loathsome, repellant and ennuant to the practitioner, because of which so little surgical principle is applied to their management. How frequently do we see dressings with many ointments intermixed, a "hit or miss" unguent, with no logical basis. And furthermore, you may have experienced the reprehensible practice of a physician inquiring of the patient what color salve he liked and, after spreading it on a piece of gauze, allowing him to be his own dresser! It is this indifference, shared by patient and physician alike, which, in a great many instances, has made ulcers really chronic and sent many of our patients adrift.

It is fair to assume that a condition which is so common, painful, distressing, and disheartening, should arouse in us a great desire to cure a malady that has often taxed the skill of dermatologist, internist, and surgeon alike. If we carefully consider why

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this task, wrongly assumed, thankless, makes us panic-stricken and gives us a hopeless sensation, it will readily be seen that it is for the same reason that the patient continues a patient, viz: failure to cure.

If every sort of measure, whether based on empiricism or on theory, has been exhausted in these many years, what follows can represent nothing very new and startling. It is solely the result of daily observation and treatment of a large series of cases with that care and individual attention a surgeon applies to any major task.

It seems advisable to briefly consider the causes of

venous circulation are perhaps the most frequent etiological factors productive of diminution of the nutrition to the superficial tissues. So a locus minoris, resistantiae, trauma and infection, are enough to produce an ulcer. No consideration will here be given to ulcers resulting from diabetes, typhoid, tuberculosis, syringomyelia, syphilis, or tabes. Our concern will be with that type of ulcer that most frequently causes failure to cure, and tests our patience to the utmost—the chronic, indolent ulcer; that one which, in the greatest percentage of cases, is caused by circulatory disturbances, arterial or venous, more commonly venous, and sometimes a combination of both.



Fig. 1. Mr. E. G., age 62. An annular ulcer of four years' duration in a patient with varicose veins and cardionephritis.

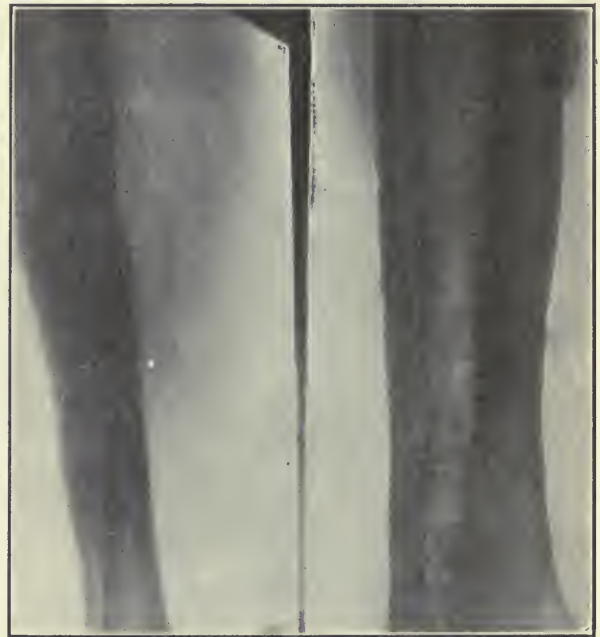


Fig. 2. Tremendous productive periostitis in patient of Fig. 1.

leg ulcer. Those predisposing are age, sex, occupation, social and constitutional conditions. The local circulatory predisposing causes may be found in the arteries, veins or lymphatics. The exciting causes are trauma and infection. The fourth and fifth decades of life are most favorable to the production of ulcer. It is my impression that its incidence is greater in females than in males. Occupation is an important factor. Those who stand all day, with very little exercise to increase the peripheral circulation, are more prone to leg ulcer. To cite, a motorman is more apt to varicose veins and circulatory disturbances than a conductor who walks back and forth in the car. Any condition that contributes to changes in the peripheral arterial wall or its lumen is contributory to the production of ulcer. Varicose veins, phlebitis, and obstruction to return

It is an ulcer that occurs in one of the crural or malleolar regions of the leg, and may be annular, serpiginous, or punched out. Its base is very sluggish, may be covered with a grayish exudate, or have a dull, glossy appearance. The extent of granulations is retarded or excessive, the edges are rolled in and indurated, and the surrounding tissue is pigmented, hard, and sometimes very tender—all these being phases of accompanying eczema and cellulitis.

How are we to cure such an ulcer? We must set out with a full determination to heal; we must have our hearts in the case. The co-operation of the patient is absolutely essential, but unfortunately, in most instances, his economic status is such that instructions cannot be carried out to the letter. Any etiological factors that might predispose to the prolongation of



the life of the ulcer must, of course, be dealt with. The ideal initial treatment is to put the patient to bed, but circumstances often forbid this, and then the case must be treated ambulatory. The patient should be encouraged to improve his general hygiene, to keep his body as clean as possible, to wear shoes with uppers that in no instance will cause any undue pressure, and to lay aside garters.

Granted that the case is one that cannot be treated in the ideal manner, how should the ulcer be attacked? Foremost is the question of infection. In any ulcer that is at all infected, and most of the type alluded to are, epithelization takes place with difficulty.

known that a countless number of these remedial agents has been used. The last recommended, I understand, is an ointment containing pituitary extract. From now on it becomes a question of the use and not the abuse of antiseptics.

There is this surgical principle to be considered, that an ulcer of the type under discussion cannot be sterilized and cured all at once. Non-appreciation of this fact is, I believe, a pitfall to many. In the use of an antiseptic by which it is attempted to sterilize the surface of an ulcer *in toto*, it will readily be realized that tissue must be killed, and that wherever this happens there is produced a favorable medium for



Fig. 3. Mrs. R. S., age 50. A crural ulcer of seventeen years' duration shown healed after six weeks.

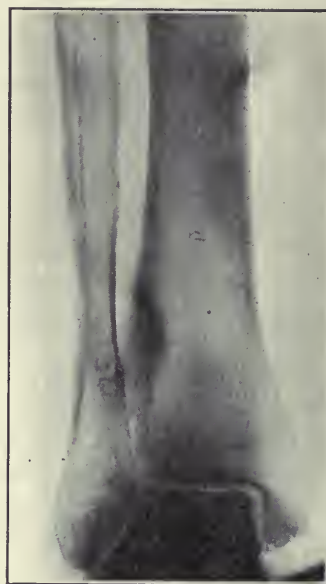


Fig. 4. Chronic bone abscess at lower end of fibula in patient of Fig. 3, with additional bone changes.

To facilitate this, I emphasize a practice that has served we well in every case of leg ulcer, to scrub the granulations thoroughly with either soft or neutral soap. Even though this procedure might at first seem harsh and cause the patient pain, in a short time he becomes so accustomed to it that if this part of the treatment is overlooked he considers it an error of omission. It goes without saying that mechanical cleansing of any infected area reduces the bacterial count. But this is not sufficient. The surrounding skin is continually infected from the ulcer, and vice-versa, the ulcer from the skin, a vicious cycle. Therefore, it is very important to cleanse the ulcer and surrounding skin simultaneously. The additional cleansing agents for the skin are benzine, alcohol, and ether. Quite naturally our thoughts would next turn to the use of antiseptics. At our command we have caustics, lotions, ointments, and powders. It is well

the growth of bacteria. With this in mind, and from many unpleasant experiences, I have abandoned the use of pure carbolic acid, and Churchill's tincture of iodine in leg ulcer, except where it is desirous to clean and level exuberant granulations as by a caustic. The weaker antiseptic ointments *e. g.* boric acid, do not clear up the infection. Occasionally, blue ointment, or starch and blue ointment have been successful. The ideal antiseptic is one that produces its effect slowly and on the organisms alone, *i. e.*, without the possibility of killing tissue. For this purpose I have employed an ointment that corresponds to the Carrel-Dakin solution, commonly known and marketed as chlorazene paste. But the product must be made fresh daily in order to have the necessary equable content of chlorine. The ulcer is filled with paste in such a manner that none of it is either squeezed out or escapes on the surrounding skin, for



then it becomes an irritant. To avoid this, the skin must be protected by either vaselized gauze or zinc oxid ointment.

The second area of infection with which we have to deal is the surrounding cellulitis. This extremely



Fig. 5. Mr. M. M., age 37. A Malleolar ulcer of four years' duration, the initial size being represented by area of pigmentation. The ulcer as seen took about four months to heal, thus demonstrating the extreme difficulty of terminal epidermalization in some cases.

troublesome and painful condition, causing inability to put any weight on the foot, may even cause more or less insomnia. The skin is generally exquisitely ten-



Fig. 6. Sclerosed malleolar artery designated by arrow under malleolar ulcer in patient of Fig. 5.

der and red, and presents the signs of an acute inflammation. Here there is another therapeutic pit-fall. The first impulse is to attack the flame without regard for the fire, and immediately a wet dressing is applied, such as, aluminum acetate solution, lotio rubra, or lead and opium wash. This is treating a symptom when the cause can just as easily be dealt

with, and is, I believe, against a therapeutic principle. When the ulcer has reached such a stage, the patient is best advised to elevate the leg. With attention to the ulcer itself, the cellulitis then very rapidly disappears.

The other structures that suffer by reason of the initial infection in the ulcer are the bone, the blood-vessels, and the lymphatics adjacent to it. These have been described also by Dudley Morris (*Surgery, Gynecology and Obstetrics*, January, 1920). The bone changes are quite remarkable. (Figs. 2, 4, 8, If the infection has persisted long enough, there is an extensive productive periostitis of either the tibia or fibula, or perhaps both. If the ulcer is on the tibial



Fig. 7. Mrs. A. T., age 48. Crural ulcer of eight years' duration with Reverdin grafts applied after preliminary preparation with chlorazene paste.

side of the leg, low down, it will be noted that the periostitis is perhaps more marked immediately beneath the ulcer, but this is not necessarily true. There may be more evidence of it, roentgenoscopically, at the upper end of the tibia and, strange to say, involvement also of the periosteum of the fibula. This productive periostitis at points distant and opposite to the ulcer is quite characteristic. The fact that the pathological changes rarely go on to an acute osteomyelitis is, I believe, due to the local and general resistance. In one case, I have noticed the production of what I believe to be a chronic bone abscess. (Fig. 4). The mode of infection of the periosteum may be in one of two ways: either by direct extension through the tissues to the bone, or retrograde by way of the lymphatics accompanying the bloodvessels, and thence by migration through the vascular wall to



the bone. The bloodvessel changes are purely local, independent of any general or peripheral arteriosclerosis. Thus, it is quite common to see a sclerosis of one of the "malleolar vessels" under a malleolar ulcer. (Fig. 6). These changes may, however, extend even further up, and to my mind, operate to form a vicious cycle. Thus, after an ulcer has been completely healed, it may again break open because of a lighting up of an infection dormant in the deep tissues, which emphasizes the importance of these changes.

Very important is the pressure bandage. The width of the bandage should be made to conform well to the shape of the leg. The patient invariably prays for a tight bandage, and there is no reason why his prayers should not receive attention. The tight bandage seems to produce the best results. The pressure should be even, beginning from below upward, and should never be too great at the upper part of the leg, for then it produces the effect of a garter. Wherever the bandage does not conform well to the shape of any of the crural regions, it is well to place a piece of gauze under it. A bandage properly applied will support the venous circulation and help splint the ulcer, and should stay on at least a week. Who has not seen patients return in disgust the day after a pressure bandage was applied, because it had fallen down?

After all is said and done, what we aim to accomplish is growth of epithelium, and of such epithelium as is not likely to break down again with the proper care. It is a fundamental surgical principle that lastingly good epithelium can best be obtained on a clean granulating surface. To promote epithelization, I have greatly favored the use, but not abuse, of scarlet red ointment. It is common practice to see this ointment applied in the same manner as boric acid or zinc oxide ointment—spread over the entire granulating surface and the skin to boot. This should not be done for two reasons: first, scarlet red is an irritant, and as such, will not behave properly on the skin; second, epithelium can be produced only from epithelium as an "anlage", and so one cannot expect to find small islands of epithelium springing up in the center of a granulating area unless from epithelium latent in these granulations. I follow the technique originally described, namely, to place the ointment either with a toothpick or probe in juxtaposition to the epithelial edge, at the periphery of the ulcer.

Accessory to this, a mechanical aid to epithelization is to be found in the judicious use of adhesive plaster. It has long been known that epithelium will grow

under adhesive plaster very rapidly. The reasons for this, I believe, are its irritant, and immobilizing qualities. Further, it acts as a bridge across which epithelium slowly but steadily marches, and in addition, it helps to level granulations. To occlude the surface of the ulcer *in toto* with adhesive strapping, depending upon luck to bring forth new epithelium, is unsurgical to say the least, in that no room is allowed for drainage. Nevertheless, I have seen epithelium produced with a featherbone strapping over an infected area, but with resultant eczema, maceration, and severe pain. It has therefore proven very gratifying to lay on adhesive strips that have been flamed on both sides, and never, of course, completely around the leg, in such a manner that there is always



Fig. 8. The deep bone changes in patient of Fig. 7.

Fig. 9. Patient of Fig. 7, six weeks after skin graft.

a small interval of granulating surface between the adhesive strips in order to allow for drainage.

The value of applying the silver nitrate stick to the edge of the granulations to promote epithelization has, I believe, been greatly over-estimated. It is a matter of common observation that the terminal rate is a great deal slower than the initial rate of epithelization. Thus, an ulcer about the size of a quarter may heal until it gets to be about the size of a split pea, and then the final closure of the ulcer may take about twice as long as all the rest of the epithelial growth. (Fig. 5). Any epithelium that is movable over the underlying structures will be more viable than that which is very closely adherent. The most viable of all epithelium is that which does not come from the local area, but which is transplanted from another



healthy part of the body. I have reference to skin grafts. (Figs. 7, 9). The Reverdin or pinch grafts are the most favorable, and these must, of course, be applied with due respect to surgical principle; the base of the ulcer must be reasonably clean, as well as the area from which the grafts are taken. The post-operative care of grafted ulcers can be summed up in a nut shell: cleanliness, an outlet for drainage, rest, and any of the good mechanical means to avoid friction.

In the treatment of an ulcer that is almost closed, but that has a distinct varicose eczema, scrubbing with soap and water should not be resorted to, as against an elementary dermatological principle. Therefore, when an ulcer reaches this stage, it is best, I believe, to use a bland, non-irritating ointment such as zinc oxide ointment or Lassar's paste.

When all the foregoing methods have favored complete closing of the ulcer the pressure bandage should be discontinued, and in its stead a well fitting elastic stocking should be applied in order to further the circulation in the varicose veins. It should have no ridges or seams to produce any undue pressure. The patient is instructed to take a daily bath, with especial attention to the cleanliness of feet and legs.

When we consider the huge economic loss to the community and to the individuals, that results from treading the beaten path to dispensaries for many years, it is self-evident that our hospitals, given over to the treatment of every conceivable type of medical and surgical condition, should provide for the care of these people, who have in a great many instances sought admission. I consider that some start would be made to the solution of the problem if only a few beds in each hospital be relegated to these unfortunates.

#### CONCLUSIONS:

1. A whole-hearted interest should be taken in the treatment of leg ulcer.
2. After etiological factors have been removed as far as possible, the great problem of infection must be dealt with.
3. There are two vicious cycles as regards infection: first, reinfection from the skin, and second, reinfection from the deep structures.
4. An ulcer cannot be sterilized all at once by a powerful antiseptic. Under such a condition, tissue is killed, and thus a favorable medium for growth of bacteria is produced.
5. A slowly acting antiseptic, such as chlorazene paste, would seem to be more nearly the ideal.
6. To promote epithelization, ointments and mechanical factors must be used but not abused.

7. Finally, I add my plea for even a modest allotment of hospital beds for leg ulcer patients.

27 EAST 81ST STREET.

#### A REPORT OF 79 CONSECUTIVE CASES OF MALIGNANT GROWTHS TREATED WITH X-RAYS.

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The virtue of the report which I shall render, if virtue it contains, lies in the fact that the remedy has been used upon a variety of consecutive and not on selected cases. No case, since the beginning of the series, was denied treatment, though some were treated regretfully, and without hope being entertained by myself or held out to the patient. In February, 1917, there was published in this Journal a paper which I had previously read before the Western Roentgen Society at its meeting in St. Louis, June 9, 1916, entitled "A Preliminary Report on 45 Cases of Malignant Growths, Treated With X-Rays". Out of deference to the conservative beliefs of the medical profession on the subject of cancer cures and possibility of recurrences, and in justice to the grave subject at issue, that paper was dubbed a *preliminary* report.

I wish at this time to make a final report on the 45 cases comprising that series, as well as on 34 additional consecutive cases, on which treatment was completed or terminated in July, 1917, when I joined the army.

I shall report end-results only, on most of the former series of cases, in order to avoid occupying valuable space unnecessarily, and I refer the reader to my original report.

Cases 29, 33, 34, 47, 48, 49, 50, 51, 52, 53, 54, 55, 59, 61, 63, 64, 66, 68, 69, 73, 74, 78, 80, 81, 83, 84, 86, 87, 88, 91, and 92, are alive and free from cancer.

Case 30 died March 29, 1919, of cystitis. Case 31 died in 1917 of metastatic carcinoma. Cases 32, 56 and 72 are all dead of paralysis. Case 82 died in 1919 of metastatic carcinoma. Case 71 was reported in the original paper as having discontinued treatment. He later again demanded treatment, but was a hopeless case from the beginning and died in 1916.

Case 70 was originally reported as having died of angina pectoris before his case was decided. Case 82 died in 1919 of metastatic carcinoma.

Cases 35, 38, 41, 42, and 60 were originally reported as fatalities.

Case 88. Man, 57. Carcinoma of muco cutaneous margin of lower lip. Duration 3 months. Intensive soft ray dose December 28, 1915; and February



8, 1916, and massive dose December 28, 1915. Omitted from previous report for reason that I had not been able to ascertain end-results.

Case 96. Man, 25. Primary carcinoma cutis, right side of nose; duration 3 years. Originated in a telangiectasis. Intensive soft ray dose March 11, 1916.

Case 97. Woman, 36. Post-operative cuboidal-celled carcinoma of skin near anal margin; duration 1 year, massive filtered dose March 21, 1916.

Case 98. Man, 76. Carcinoma at end of nose, supervening on acne rosacea; duration 9 months. Intensive soft ray dose April 12 and May 22, 1916.

Case 99. Man, 72. Cornu cutaneum of right ear; duration 3 years; treated by desiccation method.

Case 100. Woman, 85. Rodent ulcer, right frontal region; duration 3 years. Intensive soft ray dose May 16 and June 14, 1916.

Case 101. Woman, 40. Post-operative recurrent carcinoma cutis, left malar region. Intensive soft ray

Case 105. Woman, 59. Post-operative recurrent cuboidal-celled carcinoma, right breast; duration 6 months. The operation was a simple breast amputation on August 16. Recurrence noted in wound September 10, and a hard mass, the size of a pigeon's egg midway between wound and axilla. Biopsy in this case by Dr. B. G. R. Williams. Massive doses to entire breast and axilla August 27, September 10, October 14, 1916.

Case 107. Man, 37. Sarcoma, left axilla; duration 3 months. Very rapid growth. Massive doses with maximum filter July 31, August 12, September 5, to entire shoulder and chest. Empyema developed September 16. Metastasis in dorsal region caused paralysis and death.

Case 108. Man, 72. Carcinoma, left temporal region supervening on lupus vulgaris; duration 3 years. Biopsy: basal-celled carcinoma. A salient tumor  $2\frac{1}{2}$  inches in diameter. Intensive soft ray doses August 30 and November 13 to tumor and



Fig. 1. Case 122. Multiple keratotic basal-celled cancer—before treatment.

dose July 3 and August 16, and massive filtered dose November 10, 1916.

Case 102. Man, 68. Cuboidal-celled carcinoma of right side of face and right ear and involving the temporal bone. Duration 6 months. This man had been treated by me and cured of a basal-celled growth on left side of face near the ear, in 1912. When he appeared with the second lesion April 12, 1917, he was in an incurable state and showed practically no favorable reaction to the treatment. When I joined the army he was referred to Dr. Goosmann of Cincinnati. He later suicided with a shotgun. It is not generally believed that cuboidal-celled growths can be of keratotic origin. However, I had many solar keratoses, one of which had produced a malignancy as early as 1911, and another was undergoing a typical degeneration on the skin of the right malar region. He described a karatosia as the precancerous state of the lesion 1917.

Case 104. Man, 74. Sarcoma, left hip; duration very recent; under observation one month before treatment. Massive dose with maximum filter, August 20, September 20, and December 31, 1916.



Fig. 2. Case 122. Multiple keratotic basal-celled cancer—after treatment.

massive doses to entire area September 2, October 16, and December 4, 1916.

Case 109. Man, 67. Carcinoma cutis, basal-celled, left mastoid region; duration 18 months. Intensive soft ray doses September 26 and December 15, 1916.

Case 110. Woman, 53. Carcinoma of lower lip near median line; duration 1 year. An intra-mural tumor. Massive doses November 20, 1916, and January 29, 1917.

Case 111. Man, 79. Carcinoma of foreskin near corona; had been excised by family physician with prompt recurrence; duration (of recurrence) 4 months. Intensive soft ray dose to lesion November 8, and massive doses to penis and both inguinal regions November 9, 1916, and again to penis January 7, 1917.

Case 112. Woman, 45. Post-operative recurrent scirrhus type cuboidal-celled carcinoma of right breast; duration 6 weeks. Biopsy by Dr. B. G. R. Williams. Simple amputation. Massive doses to entire breast, mediastinum and axilla, December 4, 11, 18, 1916, February 7, 21, and August 1, 1917, and to the left axilla March 19, 1917. All evidence of



disease disappeared from the breast, but she continued to retrograde. I visited her October 1, 1919, after my return from the service, finding her greatly emaciated, and was told she had been confined to bed for the preceding 6 months; bloody purulent discharge from vagina and rectum; right leg was shortened by 6 inches, due to absorption of upper part of femur and part of ilium. There had been great loss of hair and atrophy of nails and the entire skin was pigmented to a brownish shade with very many minute dark papillary growths in general distribution, but thickest on the neck and abdomen. Readily recognizable as *acanthosis nigricans*. In retrospect I recalled that the patient had repeatedly, while under treatment in 1917 complained of pain in the lumbar region which I then attributed to neuritis, but it seems probable to me now that the primary growth was pelvic in location and her breast condition secondary or metastatic. She died in June, 1920, at which time the right femur had been entirely destroyed.

Case 113. Woman, 35. Carcinoma, squamous-celled, of meatus urethrae; duration 1 year. Biopsy by Dr. M. L. Curtner. Massive doses to vulva December 19, 1916, and January 20, 1917.



Fig. 3. Case 131. Basal-celled carcinoma of face—before and after treatment.

Case 114. Woman, 58. Miliary carcinoma of omentum; duration (known) 4 months. Biopsy by Dr. B. G. R. Williams. Exploratory operation January 17, 1917. Massive doses to entire abdomen (divided into 9 areas) January 7, 8, 9, 10, 13, 24, February 3, and April 4, 1917. Abdominal symptoms greatly improved, but patient died April 25, 1917, of cerebral metastasis.

Case 115. Woman, 63. Recurrent post-operative carcinoma, cuboidal-celled, right breast and axilla; duration (of recurrence) 4 months. Halsted operation had been done. Massive doses to axilla, breast, and mediastinum, June 7, 11, and July 29, 1917. The patient remained free of cancer and died of chronic interstitial nephritis May 30, 1919.

Case 117. Man, 47. Post-operative recurrent basal-celled carcinoma, right side of lower jaw and sterno-clavicular joint. Had been operated upon in 1914—excision of lesion and dissection of cervical glands. Massive doses January 30, February 15, and March 10, 1917, to lower jaw, neck and sterno-clavicular region. Metastasis in dorsal region determined. Died November, 1917.

Case 119. Man, 55. Basal-celled carcinoma of left side of upper lip; duration 1 year. Desiccation and massive dose June 7, 1917.

Case 121. Woman, 43. Post-operative recurrent carcinoma of both breasts; duration 1 year. Massive doses February 22, 24, 25, April 30, May 28, 1917. Died October, 1919.

Case 122. Woman, 75. Multiple, basal-celled carcinoma of keratotic origin; duration 5 years. Biopsy by Dr. B. G. R. Williams. There were 5 separate lesions showing as many stages of malignancy, the worst being a salient tumor on the nose,  $\frac{3}{4}$  inch in diameter. Massive dose to nose February 17, 1917, and intensive soft ray doses to other lesions February 17, 19, and June 4, 1917. (Figures 1 and 2).

Case 123. Woman, 44. Recurrent, post-operative adeno-carcinoma of cervix uteri; duration 8 months. Biopsy by Dr. Will Shimer. Panhysterectomy, January 15, 1917. Recurrence was prompt; a growth as large as a pigeon's egg was visible on February 21. Massive doses to entire pelvic area and inguinal regions, February 22, 24, May 2, 14, June 25, and through speculum direct to lesion, March 18, April 12, and June 25, 1917.



Fig. 4. Vaginal specula devised for direct x-ray treatment of cervix as an accessory to usual method, and method of attaching to the standard Victor tube stand. Specula are triple coated with shellac before use for protection against secondary rays.

Case 124. Man, 69. Carcinoma of right malar region; duration 8 months. Massive dose to lesion, a salient tumor, March 2, 1917. He died suddenly March 21, 1917, of valvular disease of the heart.

Case 125. Woman, 54. Carcinoma of gums, and right side of superior maxilla; duration (cancerous or pre-cancerous) 3 years. Massive dose through speculum to side of face, April 4, and intensive soft ray dose through speculum May 25, 1917.

Case 127. Woman, 41. Post-operative sarcoma of right thigh extending to hip joint; duration 5 months. Massive dose to inguinal region March 17, 1917. Disarticulation of hip was done March 18; massive dose to stump March 28 and June 4 and to an enlarged gland on stump on May 2.

Case 128. Man, 42. Basal-celled carcinoma of left side of upper lip; duration 1 year. Massive dose to upper lip March 18, and intensive soft ray dose April 2, 1917.

Case 129. Man, 50. Carcinoma of left side of inferior maxilla; duration 6 months. Massive dose to entire lower jaw. Died May 30, 1917, with destruction of the bone.

Case 130. Man, 65. Basal-celled carcinoma right



side of neck; duration 10 years. A large salient tumor, 2 inches in diameter. Massive dose April 21, May 25, and July 16, and intensive soft ray dose July 16, 1917.

Case 131. Man, 53. Basal-celled carcinoma of face in front of left ear; duration 1 year. A salient tumor. Massive dose May 10, 1917. (Figure 3).

Case 132. Man, 68. Basal-celled carcinoma, right side of nose; duration 5 years. Massive dose to nose May 14, 1917.

Case 134. Man, 74. Cuboidal-celled carcinoma, right side of face; duration 1 month. Intensive soft ray dose June 17, 1917.

Case 135. Recurrent post-operative carcinoma of left side of face and lower maxilla; duration 5 months. Massive doses to jaw, and neck, July 16, and August 19, 1917. The patient died with destruction of the bone.

#### SUMMARY.

*Cancers of Uterus*, five cases. All were post-operative inoperable recurrences. One had an irremediable urinary fistula from the time of her operation causing the vaginal closure to open and indicating that a ureter had been obliterated during the operation; this case went consistently to a fatal result. One discontinued treatment after one séance and reappeared for treatment a few months later in a hopeless condition. Three died of metastasis, and one is alive and free from cancer.

*Lower Maxilla*, five cases. Four terminated by destruction of the mandible and death and the fifth by metastasis in dorsal region of the spine.

*Female breast*, seven cases. One died of pelvic carcinoma. One discontinued treatment and later died of the disease. One died, 2 years after treatment, of nephritis and four are alive and free from cancer.

*Penis*, two cases. One was in an advanced state with considerable destruction and amputation was resorted to together with massive *x*-ray doses to inguinal regions. Both patients are living and free from cancer.

#### SUMMARY OF FATALITIES.

Cases going to a fatal termination were: uterus 5, female breast 2, lower jaw 5, cranial bones 3, axilla 1, omentum 1.

#### SUMMARY OF SUCCESSFUL CASES.

Recoveries from the disease were: uterus 1, female breast 4, skin of anal region 1, axilla 1, lower lip 6, upper lip 2, penis 2, vulva 1, thigh 1, hip 1, parotid gland 1, chest wall 1, skin of leg 1, buccal mucosa 1, and face, neck, and hand 31.

#### COMMENT.

A notable advancement has occurred within the past half decade with regard to uterine cancer, to wit: almost all good surgeons have broadened their

knowledge of cancer and no longer hold out a promise of cure of uterine cancer solely by surgery. They have learned something of the value of *x*-rays and seek post-operative treatment for their patients. Nevertheless there are still exceptions to that. Within a month prior to the writing of this, a good, but over-enthusiastic surgeon made the pronouncement in the *Indianapolis Medical Society*, that "surgery is the *undefeated enemy of cancer*".

The truth is that intelligent and unprejudiced team-work by the surgeon and roentgen therapist will redound to the credit of both by saving many lives. If either fails to avail himself of the aid of the other in behalf of his hapless patient, he is recreant to his trust.

It is my opinion that the Halsted's and similar radical operations on the female breast are no longer justifiable, inasmuch as it seems almost generally agreed upon that cases of breast cancer should have proper post-operative treatment. Radical extirpation of the breast and lymphatic glands, without *x*-ray treatment, has been followed in the past by such an enormous percentage of recurrences and metastatic attacks that it would seem there should be no argument as to the advisability of post-operative *x*-ray treatment.

Granting such to be the case, the logical procedure should be, extirpation of the tumor or amputation of the breast and enucleation of all palpable axillary glands, but no general dissection of glands, the operation to be *preceded* and *followed* by *x*-ray treatment.

Lamentable experience with bone cancer leaves me hopeless of any success with such cases. I have never yet seen cases with bone involvement do other than go rapidly to a fatality. Surface cancers are all amenable to treatment. But if they are permitted to go to an advanced state and attack adjacent bones, death is certain. There are many deaths from cancer of the inferior maxilla and these are practically all secondary to neglected cancer of the lips. The crux of this problem is education of the general practitioner, for he is close to the people.

Cancer of the lip has been believed in the past to be incurable. *Not so!* With this, as well as some other superficial cancers, it is merely a question of anticipating metastasis, (which in case of cancer of the lip is prone to occur early) or dealing promptly and vigorously with the metastasis when it has occurred.

210-211 STATE BANK BUILDING.

In cases of fracture where an end of the bone lies close beneath the skin do not place a pad or any pressure whatever over this point.



CERTAIN PROTEAN MANIFESTATIONS  
OF CHRONIC APPENDICITIS.

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In the *New York Medical Journal*, June 7, 1919, I presented a study of chronic appendicitis with special reference to an obscure but constant syndrome. That paper was based upon four patients—all young adult males—in whom the predominating symptoms were obstinate constipation and nerve-fag of varying degree; in all cure was obtained by removal of the appendix. I wish to present the histories of five additional cases, in several of which one could scarcely believe that the appendix was the cause of all the mischief, and to make some comments upon each case.

CASE I. A. P., female, white, aged 41, married, has for several years felt extreme "weakness" in stomach, manifested by discomfort, gnawing, and sensation as though stomach were "falling apart". Since childhood she has been habitually constipated; when constipation continues the patient feels "shot to pieces"; very often she knows that she should go to stool, but she does not have the sensation, although when she has the sensation the stool passes easily.

On October 5, 1918, the patient was suddenly attacked by influenza, and ten days later pneumonia developed, which confined her to bed for five weeks. At the end of the five-week period she became despondent and could see nothing bright; she did not feel clear in her head; she had brain fatigue—it was an effort to think or collect her thoughts; she began to stare. At times she dreaded seeing friends; at other times she was anxious to see them. She was apprehensive that she never could get well. She was sent to an asylum, where she did not sleep weeks or months; in May, 1919, she began to sleep from 1 to 4 in the morning. Now she might sleep all night, or her sleep might be disturbed. She never awakes refreshed and does not care to arise in the morning. For a long time she could not lie still in bed, but would toss about. There was no loss of memory. There was shortness of breath at times.

At the time of physical examination (November 29, 1919,) the patient stated that her appetite was good, that she had no discomfort after eating, and that she was not noticeably disturbed by gas. She did not feel that eating gave her strength. One day she would feel all right, but the next day without apparent cause her anxieties would come back. She felt as though she were trying to lead a normal life in an abnormal manner—living from hour to hour. Her bowels were bad; she had poor motor control. She had hot flushes. Her feet "went to sleep"—one or the other, more often the left foot. She could not forget herself; when talking to some one she at the

same time was thinking of herself. There were shooting pains, which travelled to various parts of the body. Following the influenza there was eyestrain, for which the patient wore glasses; she could not read, the lines in the newspaper running upside down and then together. She had nasal catarrh, the right nostril always being stopped up. Her tonsils had been removed. There were no painful teeth—in fact, the teeth were in good condition. There was a bad taste in her mouth. There was definite tenderness on palpitation at McBurney's point.

The diagnosis was made of chronic appendicitis with psychesthenic syndrome from intestinal auto-intoxication. There was also chronic hypertrophic rhinitis. The patient was advised to have her appendix removed and her nose treated.

On January 16, 1920, the appendix was removed, using local anesthesia and morphin-hyoscin narcosis. The appendix was 4 inches in length, and there were numerous adhesions about its base to the cecum. The following notes record the patient's progressive improvement.

January 17. Sensation of pressure on top of head gone.

January 19th. Able to relax today for the first time. Bad taste in mouth has disappeared.

January 21st. Had a night's good sleep. Her bowels moved. She is "terribly" hungry. She already feels better than she has felt since the influenza attack.

January 25th. Shooting pains have gone from body. Numbness of hands has disappeared. Appetite improved.

January 28th. Menses appeared.

January 29th. Ate bologna sausage and pickle without any after-distress.

April 14th. A letter from patient's husband states that as regards mental depression his wife is very much improved; that while she is occasionally depressed, yet she can concentrate better than in the past. Exertion does not prostrate her as before. There is dyspepsia occasionally, but not so frequently as heretofore. Owing to lack of exercise the patient's bowels do not move without laxatives.

January 2, 1921. It is now almost a year since the patient was operated upon. She is the picture of health, and all her symptoms have entirely disappeared. Her bowels move regularly.

This case might have been regarded as one of "post-influenzal neurasthenia", but she had doubtless been treated for that prior to removal of the appendix, without improvement. And neurasthenia, as we look upon it today, usually is but a reflection of some underlying disturbing factor (local irritation). The hypertrophic rhinitis received treatment about ten days after the operation and soon cleared up; sinusitis was looked for, but not found. The numerous adhesions about the base of the appendix were indicative of chronic appendicitis—the type that in my experience so often slows the motor activity of the



bowel, resulting in intestinal auto-intoxication and the psychasthenic syndrome, now less pronounced, now more pronounced. And the improvement beginning the day after operation and progressing with checking off of the symptoms day by day up to complete cure was quite similar to that in the other cases in this series. The bowels moved naturally on the fifth day after operation—the first natural movement for many months. It is possible that the influenza infection aggravated the chronic appendicitis, for cases of post-influenzal appendicitis have been reported in the literature.

CASE II. I. B., white, female, aged 25 years, married, complained of pain in right "side." She has been constipated the greater part of her life. For years there have been frequent belching of gas, often a bitter taste in the mouth, and often slight, sharp, sticking pains in right "side." One week previous to the examination she complained of loss of appetite, headache, and pretty severe pains that caused her to hold her side. This trouble has lasted a week without getting better. There have been, in addition, attacks of nervous depression from time to time. The constipation has occasionally been obstinate, the patient often going to stool without any result.

There was definite tenderness at McBurney's point.

On September 11, 1920, the appendix was removed under local anesthesia; it was only 3 cm. long, of matchstick diameter, kinked, and with a short, fatty mesentery. There were a few ancient adhesions. The distal half of the lumen was wholly obliterated.

On September 15th, four days after operation, the patient had a natural bowel movement, the first natural one for many years, and from this time on there was regularly a daily, natural movement. Improvement progressed rapidly, the symptoms disappeared one by one, and the patient developed a ravenous appetite. Her weight gradually increased, and eventually she became the picture of health.

This is a very typical example of the subject under consideration, with characteristic symptoms, characteristic operative findings, and characteristic improvement after operation. It is quite common in these cases for the patient to have the first natural bowel movement in years on the fourth or fifth day after operation—so much the rule, in fact, that I withhold enemata in anticipation of such an event. The appendix in this case was of the typical obliterative type, which so frequently is the cause of pylorospasm.

CASE III. A. C., white, male, aged 28, tailor, has for 3 years continually suffered from pain in right "side" and at times in epigastrium. This pain is burning, sharp, or cutting, and radiates to right hip and right knee. The bowels are regular; there is no gas on the stomach, no dyspepsia, no indigestion. The patient sleeps well at night after the pain dis-

turbance passes. He has lost no flesh, but cannot gain any. There is no burning on urination, and examination of the urine is negative.

There was no tenderness at McBurney's point, but digital pressure exerted there reproduced the pain in the epigastrium of which the patient complained. There were also four carious snags in the mouth.

The diagnosis in this case was withheld, so atypical were the history, symptoms, and physical findings. The patient was advised to have the four snags extracted and was given a prescription for *nux vomica* and soda in gentian. There followed an improvement that was more apparent than real. After observing the patient for two months there was found one day on physical examination tenderness in the right iliac fossa, and appendectomy was thereupon advised.

Operation under local anesthesia disclosed a rigid, tubular appendix kinked in its middle and surrounded by filmy adhesions.

After the operation improvement was progressive. When seen two months later the patient stated that all pains and other troubles, including the burning in the epigastrium, had disappeared. He gets up in the morning with a clean mouth—his tongue is not coated as it used to be. His appetite is better. He feels more like working. His friends tell him that his color is better.

This case was atypical in that—aside from a coated tongue and occasional burning in the epigastrium—there was no disturbance of the digestive tube. The occasional sharp, cutting character of the pain with radiation to the right hip and right knee suggested renal trouble rather than appendiceal. (It was probably due to the periappendiceal adhesions.) And yet the appendix was the seat of definite chronic inflammation, and the patient's symptoms cleared up after removal of the organ. This is a case where differential diagnosis is best established by observation over a period of time.

The next two cases are likewise atypical in that one was complicated by pregnancy, and the other manifested signs of enteritis—hyperperistalsis and diarrhea.

CASE IV. A. C., white, female, aged 29, married, pregnant 3 months, complained of persistent vomiting, which began two weeks previous to the examination. The vomiting came on two hours after each meal, preceded by marked nausea. The vomitus was greenish. The last 5 or 6 days the patient continually vomited and without taking anything into the stomach. Two years previous to examination the patient received a course of treatment for supposed gastric ulcer. She complained of no pain in abdomen, but there was a tender feeling in the right lower quadrant. She has been habitually constipated since early childhood.

There was tenderness over the right lower abdominal quadrant, extending along the iliac crest to



the loin. Pressure at McBurney's point caused definite tenderness and, if continued, gave rise to pain in the epigastrium and nausea.

The diagnosis of appendicitis was made in the face of the probability of the nausea and vomiting being due to pregnancy. In fact, the patient's family physician favored the latter explanation. The previous history of stomach disturbance in conjunction with the localization of the tenderness during the present illness, suggested what Moynihan has so aptly termed "gastric ulcer in the right iliac fossa."

Operation was performed on August 4, 1919. The appendix was surrounded at its base by veil-like adhesions. It was the size of a narrow lead pencil and of uniform diameter throughout its length. The subserosal vessels were injected, the coats were thickened, and the lumen was diminished. There was no kink or angulation.

A note made the day after operation stated that the pain in the right iliac region had disappeared and that the patient was no longer nauseated. On the tenth day after operation the patient had the first natural bowel movement for six weeks. When seen a year later she stated that she was in the best of health, had gained weight, and that her bowels moved regularly every day. This latter is in marked contrast to her history of constipation since early childhood. Her gastric symptoms had ceased.

CASE V. A. R., white, female, aged 21, married, was seen August 13, 1919, complaining of diarrhea and pain in the lower right abdomen. On October 18, 1918, she had an attack of diarrhea without apparent cause. Looseness of bowels, with slight modification, persisted to this date. In October, 1918, the stools were watery and in frequency 7 to 8 a day. In April, 1919, the patient received hospital treatment for 3 weeks—hot and cold compresses to abdomen, saline enemas, and medication by mouth. She left the hospital somewhat improved, so that now she has only 2 to 4 passages a day. The stools now vary from a watery to a solid consistency. Certain foods—especially cereals, fruits, fruit-juices and vegetables—exaggerate the looseness of the bowels. She often gets a desire for stool during a meal and on arising in the morning. This desire is ushered in by severe cramps, which may last 1 or 2 hours, the patient all this time sitting on the hopper. These cramp-like pains come and go during the day and occur especially toward evening. From one-half to one hour after each meal the patient belches gas, has a sour taste in her mouth and often brings up a sour, mucoid material. There is no nausea or vomiting. She often feels peristaltic waves "like water gurgling in the abdomen". She has lost from 6 to 7 pounds in the last 3 months. No headache. She faints very easily. She admits being of a very nervous temperament. Often her whole body quivers, especially after a hard day's work. She sleeps well and does not get up at night for stool. She suffers severely from dysmenorrhea, there being severe pain a few days before and for the first 2 or 3 days during a menstrual period.

Hemoglobin 68 per cent.; red cells, 3,390,000; white cells, 4,670. Wassermann reaction, weakly positive.

Bismuth meal studies of the digestive tube were practically negative. The roentgenographer reported; "There is no localized tenderness over the cecum, and I believe the patient does not have chronic appendicitis. I believe her diarrhea is functional rather than due to ulcerative colitis or tuberculosis. I would treat her with mineral oil. It is entirely probable that retention of material in first portion of colon may be causing irritation and secondary hyperperistalsis of colon".

The surgical estimate of the case was the diarrhea type of chronic appendicitis with neurasthenic syndrome.

Operation on August 22, 1919, revealed the ascending colon distinctly elongated and wrapped with a loose, sliding, veil-like membrane, smooth in character and more marked towards the cecum. The appendix measured  $3\frac{1}{2}$  inches in length and was of the diameter of a narrow lead pencil. It was neither supple nor pliable, but definitely fibrosed. There were no kinks, nor any peri-appendiceal adhesions.

Three days after operation the patient had a copious bowel movement, the result of an enema. Five days after operation the patient was comfortable, had slept well, and had had no further diarrhea. Seven days after operation there was a large, *formed* bowel movement after an enema. Eight days after operation there was a *formed* bowel movement—the first natural passage since October, 1918, and without the sensation of pressure on the rectum, of which the patient had previously complained. Her appetite was increasing rapidly. Four months after operation she had a spell of hyperchlorhydria—belching and acid eructations; her bowels moved three times a day, but the stools were either *formed* or semi-solid. As time went on the patient became pregnant, gave birth to a child and, as her husband expressed it "got to be just like her old self".

#### RECAPITULATION.

Case I: Constipated since childhood; abdominal discomfort; psychasthenic syndrome apparently precipitated by influenza infection; appendicectomy—adhesions; improvement began day after operation and progressed to complete cure.

Case II: Constipated since childhood; abdominal discomfort and dyspepsia; nervous depression; appendicectomy—lumen obliterated and organ surrounded by adhesions; on the fourth day after operation a natural bowel movement took place, and one occurred daily thereafter without fail for the several months that the patient remained under my observation.

Case III: Pain in epigastrium and right "side", burning, sharp, or cutting and radiating to right hip and knee; bowels regular; pressure at McBurney's point reproduced the pain in the epigastrium; appendicectomy—appendix rigid, tubular, kinked and surrounded by adhesions; after operation improvement progressed to complete cure.



Case IV: Constipated since childhood; previous treatment for supposed gastric ulcer; persistent vomiting complicating pregnancy; local signs of appendicitis; appendectomy—appendix showed acute exacerbation of chronic inflammatory process, adhesions; the day after operation nausea and vomiting disappeared and on the tenth day a natural bowel movement took place; "gastric ulcer" cured by appendectomy.

Case V. Persistent diarrhea with cramps; dyspepsia and abdominal discomfort; "nervous temperament"; anaemia, Wassermann reaction weakly positive; roentgenographic report: "functional disturbance of first portion of colon"; appendectomy—appendix definitely fibrosed, elongation of ascending colon and pericolonic loose membrane; after operation on the third day an enema was productive, on the fifth day a large formed stool after an enema, on the eighth day a formed stool—the first natural one in 10 months and without previous sensation of pressure on rectum, and as time went on bowels moved 3 times a day, but stools either formed or semi-solid; patient recovered completely and gave birth to a child.

#### SUMMARY OF SYMPTOMS.

The great variety of symptoms that may be caused by chronic appendicitis is strikingly shown by tabulation from all the nine cases which were especially studied for the basis of this and the previous paper. The number of symptoms of which any one patient complains varies with the duration of the disease—especially the duration of peristalsis inhibition (constipation)—and the type of pathologic disturbance of the appendix (adhesions, kinks, stricture, or obliteration of lumen, etc). In all these patients all the symptoms cleared up after appendectomy. To say in a given case whether or not the appendix is the disturbing factor is the difficult problem, which is best determined by judicious weighing of the symptoms and the finding of definite tenderness over the appendix.

1. *Digestive Tract.* Appetite poor; tongue coated; bad taste; acid eructations, belching ("dyspepsia", hyperchlorhydria?); nausea, vomiting (pylorospasm?); ulcer mimicry; tympanites—often relief of certain symptoms by passing flatus; constipation—habitual and often obstinate, often since childhood (hypoperistalsis); discharge of mucus from bowel, diarrhea (hyperperistalsis); pressure on rectum at stool.

2. *Nervous System* (the "psychasthenic syndrome". Depression; lack of concentration, confusion of ideas, forgetfulness; loss of energy, ambition, initiative, efficiency; restless nights—sleep disturbed by fantastic dreams; indisposition to get out of bed in the morning; fatigue—tired feeling during the day; extremities alternately cool and warm, chilli-

ness; palpitation. This group of symptoms can be attributed to the effects of toxins (fecal) upon the psychic, motor, and vasomotor portions of the central nervous system.

3. *Pains.* Teadaches, dull and at times frontal; pain around the heart, down the left arm, in the back (toxic myositis); pain in the epigastrium (reproduction by pressure on appendix is significant); pain in the right iliac fossa radiating to right testicle, right thigh, or right knee.

4. *Post-operative.* There is a gradual, progressive disappearance of symptoms, often beginning the day after operation. Among the first to go are the toxic pains and disturbed sleep—the patient sleeps more soundly, more refreshingly, and the slumber is no longer disturbed by fantastic dreams. Then the digestive tract begins to functionate normally; the bad taste disappears; the coated tongue clears; the appetite improves; there is no longer discomfort from food; regulation of peristalsis with riddance of gas and natural passage of stool, usually beginning on the fourth day and continuing thereafter daily. Pressure on rectum during stool, when present, disappears. Gain in weight. Depression disappears; ambition, energy, initiative, efficiency, and memory return.

It would be well to establish this syndrome upon the basis of pathologic physiology. The outstanding feature is constipation, which is obviously due to retarded motor activity of the bowel: the ascending colon becomes fagged. What is the cause of this retarded motor activity? The theories advanced—e. g. that of Robert Morris, according to which the sympathetic ganglia are affected,—do not quite dovetail with the findings. I wish the following theory could be proven, for it explains matters from the clinical standpoint so satisfactorily:

The appendix is morphologically the beginning of the large bowel; the appendix itself, of course, begins at its tip. Let us assume the peristaltic waves of the large bowel are initiated at the tip of the appendix, travel along that organ and, reaching its base, are transmitted to the large bowel (cecum). Now, when the appendix is fibrosed, kinked, strictured, or bound down by adhesions these irritating peristaltic waves are interfered with and reach the cecum with disturbed regularity. After removal of the appendix the peristaltic waves are still initiated at the beginning of the large bowel, but this beginning now corresponds to the former site of the attachment of the appendix. The cecum, however, being free from fibrosis, kinking, stricture, or adhesions is able to transmit regular and forceful peristaltic waves to the



remainder of the large bowel. This theory explains not only the symptoms previous to operation, but also the rapid recovery after operation.

Whatever the mechanics of constipation may be, the effect of such long continued constipation is unmistakable in the appearance of auto-intoxication with its slow poisoning of the tissues of the body, above all the fragile nerve tissues, including the central nervous system, the outlying sympathetic system, and the endocrine organs that they control.

#### CONCLUSIONS.

1. Chronic appendicitis manifests itself by disturbances of the digestive tract, and of the nervous system, by various pains and aches,—symptoms that rapidly disappear after removal of the diseased appendix.

2. These symptoms vary in number in direct proportion, usually, to the time of existence of the disease and to some extent with the type of the pathologic appendix.

3. The diseased appendix is the greatest and most frequent disturber of peristalsis of any of the abdominal organs. The theory here advanced—one that explains the pre-operative symptoms as well as the rapid post-operative disappearance of symptoms—is that the appendix at its tip initiates the peristaltic waves of the large bowel, but when fibrosed, kinked, strictured or bound down by adhesions is no longer able to functionate in this capacity; after removal of the appendix the peristaltic waves are initiated at what is now the beginning of the large bowel—the former site of the base of the appendix—and are able to continue unhampered and with regularity.

4. The diagnosis must be based upon a careful estimate of the case together with the results of local examination.

5. In view of the nervous state of many of these sufferers from chronic appendicitis it seems best to remove the appendix under local anesthesia, "stealing" it during twilight sleep. By this association method untoward reaction from the operation is practically never seen, and the nervous system recovers much more rapidly than after ether anesthesia.

#### LUNG INFECTIONS AFTER TONSILLECTOMY.

Is there any excuse for carrying a patient back to bed, flat on his back after a tonsillectomy, to "gargle" and inhale septic throat contents and blood, when he could just as easily be transported in the prone position with the head turned to one side and so let gravity keep the airways free?—RALPH M. WATERS in *The Journal of the A. M. A.*

## SOME MANIFESTATIONS OF SYPHILIS OF INTEREST TO SURGEONS.\*

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The surgeon has been one of the last to realize the importance of certain manifestations of this protean disease in connection with his special work.

Recent studies by Wassermann tests and skeletal roentgenography show how many cases of latent or unrecognized syphilis there are in our large centers, especially among our hospital patients. Probably from 8 to 10 per cent. of any large community have been the victims, innocently or otherwise, of the pale spirochaete, and of the general hospital class about 18 to 20 per cent. It is readily seen that, this being the case, the surgeon has a potential problem as regards syphilis much oftener than he realizes.

Thought of this kind may save many a case a protracted convalescence after operation.

Naturally the surgeon encounters many of the different manifestations of the disease which he at once recognizes, or suspects, but it is the atypical, unusual manifestations concerning which we must be on our guard. It would seem that at the present time every surgeon as well as the general practitioner and internist should understand that a negative Wassermann reaction means nothing as regards the possibility of an obscure lesion being due to syphilis; unfortunately frequent reminders that the surgeon many times has the opposite idea prove the contention. Many cases of old bone syphilis have a negative Wassermann reaction and often this fact has led to much confusion and trouble with such cases.

It is certainly humiliating to the surgeon to excise a testicle for supposed neoplasm or tuberculosis, and find that the trouble was a gummatous infiltration. Such an occurrence is not very uncommon. In the same way amputations have been performed for supposed malignant growth where the trouble was a gumma.

Strange as it may seem, primary lesions on the lip have been mistaken for epithelioma, and radical operations advised. In all cases where there is the slightest doubt, resort to the dark field illumination and examination of serum from the lesion will give the correct diagnosis in most cases.

In all obscure cases if one forms the habit of instinctively looking at the pupils and testing the knee jerks, much valuable information will be acquired in a minute or so of time, and some cases of supposed gall-bladder disease will be saved from opera-

\*Read at a meeting of the Portsmouth Medical Society, Portsmouth, N. H., February 1, 1921.



tion and specific treatment started early for their tabes.

Syphilis is of vastly more importance to the surgeon in regard to differential diagnosis than in regard to operative treatment for known specific lesions. The dilatation of syphilitic strictures and the correction of deformities from destructive specific inflammation, such as saddle-nose, make up a considerable part of the active surgery needed in this disease. The overwhelming majority of cases of syphilitic disease are operated upon with a wrong diagnosis, gummata being mistaken for malignancy, neoplasms, and syphilitic bone disease for osteomyelitis of pyogenic character.

Within the abdomen there are many obscure manifestations of syphilis that have been mistaken for affections demanding operation, and the surgeon must have an eagle eye in cases of obscure abdominal symptoms.

E. Martin<sup>1</sup> studied 100 surgical cases taken at random, and found a positive Wassermann reaction in 19, and only 2 of these gave clinical evidence of syphilis. The cases entered the hospital for operation for cholecystitis, goiter, and various other surgical conditions. He says, "The rapid evolution of chancre of the lip with the prompt and characteristic lymphadenitis were sufficient to exclude cancer. Nevertheless some of these were operated upon; the cutting of a wedge, quite inadequate for cancer, did no particular harm in syphilis, though there was deformity".

In regard to this Finney<sup>2</sup> found at Minnequa Hospital in 264 cases with questionable complications, there were 40 positive Wassermann reactions in the medical cases of the group, and 41 in the surgical, or 32+ per cent. in all. The surgical cases represented non-union of fractures, sluggish appendicitis abscesses, gall-bladder infections and strictures of the intestine, simulating cancer.

Nuzum<sup>3</sup> found that 8.7 per cent. of 1,000 tabetics had been subjected to laparotomy one or more times. Among the mistaken diagnosis were gastric ulcer 19, gall-bladder disease 19, and appendicitis 18 cases. One tabetic had had five abdominal sections and following each operation the old pain and persistent vomiting returned,—that is the unrecognized gastric crisis.

It is not always the chronic case with obscure abdominal symptoms that confuses the surgeon, but also the apparently acute abdominal emergency case brought into the accident ward and operated upon at once with the diagnosis of perforation of some abdominal viscus, or of an acute inflammatory process

with spreading peritonitis, has sometimes proved to be an instance of tabes.

Pericolic membranes and intestinal trouble attributed to them are conditions that have been studied considerably of late. I have knowledge of such findings in some patients that I knew definitely to be congenital syphilitic, and others that I strongly suspected of this infection. These patients all complain of the same set of symptoms,—abdominal pain, much gas, and indigestion. Some are ptotic, and all are markedly "neurasthenic". It often comes to pass that these patients are operated upon for supposed gall-bladder disease, the appendix is removed, and adhesions separated; they are better for a time and then relapse into their former state of misery. One such case, that of a young woman, definitely a congenital syphilitic, was greatly helped in this connection by anti-syphilitic treatment. It would be foolish in the extreme to say that all such cases had an unrecognized syphilis to account for them, but some observers have reached, rightly or not, very definite conclusions in regard to these cases.

There are two theories in regard to the etiology of pericolic membranes, one that they are inflammatory in origin, the result of stasis (Lane), due to "crystallization" of lines of strain, or due to membranous pericolicitis (Jackson). Cheever<sup>4</sup> believes that these veil-like pericolic membranes are congenital variations, occurring in at last 10 per cent. of individuals, causing no symptoms in the majority of cases. He says further, "The other type of membrane, whose cause is either inflammation spreading from some visceral lesion, or, as I think less likely, peritoneal irritation from intestinal stasis, are more likely to cause symptoms and require operative relief".

There is no question that many of these patients do have marked abdominal symptoms, and are a cause of worry and perplexity to their physicians and surgical consultants.

Very recently Castex and del Valle<sup>5</sup> have written at length on the subject of membranous pericolicitis, or chronic abdominal syndrome, and their contention is that practically all of these are due to congenital syphilis. Their article on the subject is well worth careful reading, even if it is not entirely convincing. They do not deny that some of these cases are benefited by active surgical treatment, but plead that all should have treatment for syphilis. Some of their reported cases showed wonderful improvement under this plan, and a number seemed to be permanently cured.

The broader subject of syphilis of the peritoneum in general has been little studied or thought of in



this country, though occasionally it must be considered by the surgeon. With all the recent knowledge concerning the usual manifestations of syphilis that interest the surgeon as well as the internist, it is surprising how little has been written concerning the possibilities of definite specific lesions of this structure. Judging by analogy, gummatous peritonitis should be occasionally met as well as other unusual manifestations of the disease.

It would certainly be hard to prove at all times that certain cases, thought to be tuberculosis, were not in reality syphilitic peritonitis. We know that it is at times most difficult for the pathologist to pronounce definitely between a tuberculous and a specific lesion and with the absence of giant cells and the tubercle bacillus it may be impossible. It has recently been shown that not a few cases of supposed tuberculous cervical adenitis were in fact syphilitic, and all careful clinicians recognize the importance of ruling out syphilis in such cases. Gummatous peritonitis is much the same in its possibilities.

Letulle<sup>6</sup> says, in regard to this, that there is a form of peritonitis due to syphilis which is of especial interest to the surgeon. This is a kind of syphilitic deformation along the colon of a very peculiar character. It transforms the ascending colon by pull of adhesions to a C or a U in shape, and often leads to obstruction. Ascites is often also produced in this form of inflammation. It is quite often associated with cirrhosis of the liver, but is a definite entity, apart from this. Graphic pictures of this deforming type of syphilitic peritonitis are shown. The parietal and visceral peritoneum are both altered in these cases, he says. The peritoneum is irregularly thickened and a dull white in color. These processes occur chiefly in the upper part of the abdomen, and the upper surface of the liver is often firmly fixed to the diaphragm by heavy adhesions. There is also a shortening of the small intestine accompanied by thickening of the intestinal wall, the flexures of the intestine are much decreased in number and there is a general stiffening of the gut. The coils are manifestly sclerosed, with right obtuse angles at the flexures, the mesentery being also thickened. All this produces a marked reduction in the length of the intestine, which may be reduced to one-half its normal length. Such findings may give rise to sudden obstructions, and in any event, though extremely rare, are of direct interest to the surgeon, and the specific origin of such conditions should always be thought of, when they are encountered at the operation.

The subject of syphilis in connection with frac-

tures is one of ever-present interest to the surgeon, and in cases of non-union and delayed union it should always be in mind. A Wassermann test should be performed in every case of ununited fracture, and in every case where union is delayed. Many such cases are found to have a positive reaction, but if it is negative, skeletal roentgerography of other bones should be employed, to see whether there is evidence from this of a previous bone lues. Acquired syphilis, as pointed out by Gellé<sup>7</sup> and others, may predispose to fracture of bone especially in the tertiary period. Spontaneous fractures in syphilis, outside of tabes, are not very infrequent. There are at work in such cases one of two different processes, either an increased general porosity of the bone, or a local lesion which has diminished the bone resistance at a certain point. Institution of specific treatment in such cases is productive of the happiest results, as I have proved more than once.

It is needless to speak of the tabetic arthropathies, perhaps, but it is unquestionable that many are unrecognized by the surgeon and treated as other conditions.

There is one most interesting manifestation in this connection, occurring in congenital syphilis rather infrequently, that is symmetrical synovitis of the knees, first described by Clutton, an English surgeon, in the *Lancet* in 1886. This condition is known familiarly in England as "Clutton's knees", and every surgeon and orthopedist should be on the lookout for it. I have been fortunate in recognizing several cases. Associated with it we are apt to find deafness and interstitial keratitis. It is apt to come on in late childhood and early adolescence, and resists ordinary treatment to a marked degree. When the correct diagnosis is made, the cases are usually at least symptomatically cured, but they do not respond to treatment as quickly as do some other manifestations of the congenital type of the disease.

Another type of rather unusual manifestation of syphilis of interest to the surgeon is luetic bursitis, first described in this country by Churchman<sup>8</sup> some years ago as luetic bursopathy of Verneuil. This luetic bursitis is often unrecognized as such, and long periods of treatment are given unsuccessfully. The condition may follow trauma, or arise without it. Churchman says, "The picture is one of an indolent affection of the bursae. The disease is quite independent of syphilitic arthritis, the bursae involved being most often those unconnected with the joints. The bursae involved are those mostly exposed to trauma, but trauma only determines the site which the disease will occupy".



I have found a number of such cases, where operation has been performed, or the patient treated by rest and heat, without results; the most startling results followed the recognition of the true cause, and vigorous specific treatment. These conditions must be sharply differentiated from the tabetic arthropathies; they are cured, and the arthropathies are not. It is not too much to say that all indolent bursitides should be most carefully scrutinized, especially if there is no definite occupational trauma to cause them, and means taken to prove or disprove their luetic origin.

It has been impossible in this paper to touch on more than a few of the unusual and sometimes bizarre manifestations of syphilis of interest to the surgeon, but if the subject matter is responsible for the recognition of one additional case of obscure syphilis that the surgeon sees, it will have well fulfilled its purpose.

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## AN OPERATION FOR VESICO-VAGINAL FISTULA: A CASE REPORT.

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Vesico-vaginal fistulae, according to cause, location and size are sometimes easily cured by operation. At other times they are most obstinate, taxing the surgeon's patience almost to the breaking point.

It will be allowed that an incisional fistula following an operation, whether intentional or accidental, if properly managed, heals kindly, and one made for drainage of the bladder is almost impossible to keep patulous. But a vesico-vaginal fistula due to pressure necrosis, as sometimes happens in confinement, the burn of a cautery, or the application of a ligature or the bite of a forceps in hysterectomy and other operations, rarely closes except by operation, and it often requires several sésances to effect a cure.

If the fistula is small and the tissues elastic and easily mobilized it is comparatively easy to close a

vesico-vaginal fistula. But if the fistula is high up towards the fornix of the vagina, and the vagina is held in a mass of cicatricial tissue, it is not an easy matter to close it. A few years ago I happened upon such a case.

The patient was a nulliparous white woman about thirty or thirty-five years of age, upon whom a panhysterectomy had been performed two or three years before by a physician in another city.

She was a working woman, which made her condition the more grievous, as the urine kept her person and clothes wet, and the smell of decomposing urine made it difficult for her to earn a living.

I thought it would be a small matter to close the opening by invaginating the fistula into the bladder with a string on a probe as recommended by R. F. Amyx, a Western surgeon, until I had her on the operating table.

The fistula, about the size of a large pin's head, was high up in the vagina, firmly fixed in a mass of cicatricial tissue. It was not only immovable, but impervious to the smallest probe under ordinary pressure. I was afraid that if I tried to mobilize the vagina I might make matters worse. It occurred to me that by making a circular incision around the fistula partly through scar tissue and extending the incision into normal vaginal mucosa below the fistula I might dissect a cuff of tissue towards the fistula which, when tied and the raw surfaces approximated with a couple of purse-string sutures, would close the fistula.

I proceeded to put my plan into execution by dissecting this cuff towards, but stopping short of, the fistula. This cuff of tissue is funnel-shaped and was tied tight near the smallest part of the funnel or stem with No. 1 catgut. The excess of the cuff was cut away and the tied stump buried under the new surfaces with two rows of catgut sutures inserted in a purse-string manner. I kept a Pezzar catheter in the bladder for a few days after the operation, though I doubt if it is necessary to do so under such circumstances.

The plan worked nicely, and the wound healed kindly. I saw the patient two or three years after the operation and she was quite well and happy that she was rid of her nuisance.

I report this procedure because after an extensive examination of the literature and inquiry among surgeons who do large numbers of operations, I have not learned of its being used before; also because it may serve some surgeons a useful purpose in a similar case: and finally, because of its simplicity.



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

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### ACTINOMYCOSIS.

Human actinomycosis is not as rare a disease as, apparently, it is generally regarded. It occurs in many countries and in various communities, urban as well as rural; and its incidence is not limited to contacts peculiar only to certain occupations. Since Israel first recognized and described actinomycosis in man, in 1878, various dicta have come to be attached to our notions of the disease, and have been handed down from text-book to text-book as accepted teachings. The correctness of some of these may well be questioned.

It is generally taught that actinomycosis invades the body through the mouth, the respiratory tract or the intestine. This belief makes no satisfactory explanation of cases of actinomycosis limited to small areas of the skin, e. g., of the hand or foot, or of actinomycosis of the soft parts unrelated to the intestinal and respiratory tracts and remote from the mouth. These probably arise—as some cases would appear to demonstrate—from direct infection through the skin, although, to be sure, transmission through the blood, without any known visceral lesion, is a possibility that has not been disproved.

The hypothesis concerning the modes of invasion of the disease is probably derived in part from its frequent localization in the jaw and cervico-facial

region, the lung and the intestines, and takes its support from Lord's discovery of actinomyces in carious teeth of uninfected individuals (1911) and, more especially, from the earlier investigations of Bostrom (1891), who found molds resembling the mycelia in actinomycotic pus, on vegetables where grazing cattle had developed the disease. He showed that particles of vegetable matter are forced down under the gum and between the teeth of cattle, and demonstrated fragments of barley "whiskers" in several of these and in the pus of a woman's submaxillary abscess. In a second published study of human actinomycosis, reporting 25 cases, (*The Lancet*, April 30, 1921), Leonard Colebrook says of Bostrom's deductions:

This chain of evidence is not, however, very satisfactory when looked at from the standpoint of to-day. We now know . . . that an anaerobic species (*Actinomyces bovis*), and not the organism described by Boström, is most commonly the infecting agent in actinomycosis, of man at any rate. Secondly, *Actinomyces bovis* has never, so far as I am able to ascertain, been met with outside the animal body. There are many species of actinomycetes recoverable from soil, but all appear to be aerobic organisms with characters quite different from those of *Actinomyces bovis*. . . .

*Actinomyces bovis* is a very delicate organism, which grows only at temperatures near that of the human body and very sparsely, if at all, in the presence of air; it also dies out very readily, especially when dried, and has not been shown to form spores. Having these characters, there is little likelihood that it has its "natural" habitat outside the human and animal body. Again, it is, perhaps, significant that the incidence of actinomycosis seems to be no greater among the agricultural population than among town dwellers; and women are affected almost as frequently as men. Finally, it may be remarked that only in a very small percentage of cases is there any record of a vegetable foreign body having been evacuated from the primary abscess or a history which suggests the probability of this mode of infection. Only one of the author's 25 cases had such a history.

In view of all the above considerations it seems highly improbable that infection is usually conveyed to man in the manner suggested by Boström. At the same time one must acknowledge that there are a fair number of well-attested cases on record in which infection seems definitely to have followed the impaction of vegetable material.

It must be said, however, that, as is indicated in the above quotation, Colebrook limits the term *actinomycosis* to infections produced only by the *actinomyces bovis* (Wolff-Israel), as proven culturally, and excludes those in which there are found granules composed of Gram-staining mycelia which culturally differ from the *actinomyces bovis*, those in which there are granules composed not of mycelia but of bacillary organisms, and those in which the infection is by Gram-staining mycelia that do not aggregate into granules visible to the naked eye. For the latter class, which Colebrook regards as a large and heterogeneous one, he would retain the term *streptothricosis*.

Homer Wright preceded Colebrook in these views. He does not regard, as does Foulerton, *actinomyces* and *streptothrix* synonymous, and would apply to in-



fections produced by the mycelia described by Bostrom and others the name *narcodiosis*.

Clinically, "actinomycosis" is accepted as a disease producing certain recognizable reactions in the tissues, and caused by a variety of mycelial organisms generally spoken of as *streptothrix*. The classification of these organisms has not been very satisfactory, however, and the confusion becomes all the greater when, for example, one reads in Park's "Pathogenic Microorganisms" (7th edition) "Certain strains of *actinomyces* grow-aerobically and others anaerobically. . . . The cultures are quite resistant to outside influences; dried they may be kept for a year or more". (Compare Colebrook.)

If infections by these various organisms are clinically the same and are to be treated by the same methods, the dispute has more interest to the bacteriologist than to the surgeon. There is, however, a very evident importance attaching to the significance of the sulphur granules so characteristic of most cases of actinomycosis. Failure to find these may lead to diagnostic error. In his "Clinical Surgery by Case Histories", recently published, Hertzler records (page 132) a fatal actinomycosis of the jaw and face, with characteristic crater-like sinuses, in which the absence of granules in the pus led him from making the correct diagnosis, which, however, was established by sections of tubercles in the peritoneum of a guinea-pig inoculated with the pus. (Morphologic and cultural characteristics of the organism not stated).

Delay or failure in diagnosis may arise not merely from absence of the granules, but also in not recognizing or not properly examining them. Says Colebrook:

Cases of actinomycosis are not infrequently missed, I think, because the surgeon does not himself search for granules in the fresh pus, but simply directs a specimen to be sent to the laboratory. Pending its examination the pus clots and the granules, being caught up in the coagulum, become more difficult to detect. Moreover, the pathologist, often not forewarned that the nature of the case suggests the possibility of actinomycotic infection, does not search for granule, but takes a loopful of pus at random for film preparations and the inoculation of culture medium. . . .

The following simple procedure may be recommended for the detection of granules whenever their presence is in doubt. A few drops of pus are collected in a test-tube half full of water and fitted with a cork. On *vigorously* shaking the tube all the elements of ordinary pus will be emulsified or at least reduced to fine shreds; if, however, actinomycotic granules are present they will not be broken up, and on holding the tube up to a light will be easily detected by virtue of their opacity as cream-colored spherical bodies of about  $\frac{1}{2}$  to 1 mm. diameter, which quickly sink to the bottom of the fluid.

Actinomycosis may involve any tissue, including bone, but it does not appear to spread through the lymphatics. At any rate, lymphatic glands show a "remarkable immunity". The acceptance of this as

a rule without exceptions might, however, also lead to diagnostic error, for the neighboring lymph glands may be extensively involved—sometimes, to be sure, by secondary infection, but also occasionally by contiguous extension of the actinomycosis itself.

The mortality from actinomycosis is high, the percentages varying with the regions involved. The purely skin infections, the least common, are the least, and visceral invasions, especially the brain, the most fatal. Of the intestinal cases, appendiceal and cecal involvement are the most common, and perhaps actinomycosis is more often the cause of suppurative appendicitis than is recognized.

Therapeutically, potassium iodid has long been highly regarded. Introduced into veterinary practice by Thomassen in 1885, it was proclaimed as a cure of human actinomycosis by Nocard in 1893. Since then it has been a large feature of the therapy of the disease as presented in all the text-books. Its virtue, once highly extolled, is now questioned. That it is not a specific must be admitted. That it exercises no influence on the disease, as some assert, may also be, but probably is not, true. Admittedly, there have been many cases in which the patient took large amounts of potassium iodid without improvement, but there have been too many instances in which the drug *appeared* to be highly beneficial for us to lightly abandon it. Cured cases have been reported in which the only recorded treatment was by iodid. The editor has seen a very threatening recrudescence of actinomycosis of the groin and pelvis, in a case twice radically operated upon, subside completely and go on to definitive cure, while—if not because—the patient was taking potassium iodid, and with no other treatment. Since extensive surgical attack sometimes fails to arrest the disease, and thorough exposure plus vigorous treatment with iodid internally and locally often does result in cure, it would be wrong to deny our patients the possible benefit of a treatment that has seemed to accomplish so much.

While therefore unwilling to accept, until better evidence is forthcoming, the opinion of some, which Colebrook seems to share, that iodine is of no benefit, we would emphasize the importance of bold surgical attack. Where expedient, the affected skin should be excised and every pocket and sinuses in the deeper tissues laid open or adequately drained. All parts of the wound should be irrigated once daily or oftener with an iodine solution, e.g., Lugol's in full or reduced strength, and potassium or sodium iodid administered *in large doses*. In the editor's case above referred to, a soldier almost moribund when admitted to the Base Hospital, the patient took 700 grains of potassium



iodid every day for several weeks after the operation, without any ill-effect! Some recommend intermitting the treatment every few days, which may be quite desirable and is perhaps no less effectual.

Copper sulphate internally has been recommended by Bevan. It can be administered, in salol-coated pills to obviate vomiting, with the potassium iodid or during periods of iodid intermission. It has not been shown that salvarsan or x-rays exercise a beneficial influence on the disease. Kolmer (*Keen's Surgery*, Volume VIII) records that "successes in the treatment of actinomycosis with vaccines are claimed by Whittier, Wynn, Dean, and Malcolm. Frazier was unsuccessful in the treatment of one case of abdominal infection. If potassium iodid fails, the surgeon may try an autogenous vaccine. . . . In Malcolm's case of two years' duration, iodid being swallowed month after month and pound after pound, two sinuses and a nodule gradually healed under weekly subcutaneous injections of a vaccine containing 4,000,000 to 5,000,000 actino-fragments". Colebrook also is of the opinion that "the treatment of actinomycosis by vaccines facilitates recovery when efficient surgical drainage of the affected tissues is secured and maintained".

In so serious and so chronic a disease as actinomycosis which often, even when the infection is limited and not unfavorably located, spreads slowly to a fatal termination in spite of every effort, and, on the other hand, may subside and get well at a time when one almost despairs of a cure, it is manifestly not easy to assess the value of any of the remedies recommended, and we must, perforce—until something better is offered—try them all, if need be.

#### PLASTIC AND COSMETIC SURGERY OF THE FACE AND NECK.

Plastic restoration of the nose is a very old if not, indeed, an ancient art. In modern times plastic operations on the eyeids—for burn contractures, en- and ectropion, ptosis, exophthalmos—have been an integral part of ophthalmologic surgery, and a limited number of men have developed skill in the cosmetic improvement of other facial features, especially the nose.

There is now, it seems to us, a quickened interest in facial cosmetic work—a field that was once exploited largely by quacks—on the part of the medical profession. This can be traced to three sources: the increased demand for this work created by the competitive struggles of modern life, on the one hand, and by the development of safe and satisfactory methods, on the other hand; the reaching out by the

general, and perhaps more especially the rhinological, surgeon for "a new world to conquer"; and, unquestionably, the large amount of successful facial reconstruction accomplished during the recent war.

It can scarcely be said that this war work evolved any new principles in maxillo-facial plastics or prosthetics. It did develop, however, several new methods of applying, several bold and novel adaptations of, old principles, which are described in the remarkable work of Gillies', reviewed on another page, and in many other books and articles. These publications, now being read with deep interest, fully elucidate the successful methods, achieved through many disappointments and failures, that will form the basis of future plastic surgery of the face and neck; but concerning cosmetic alterations, as opposed to plastic and prosthetic replacement, of the features, these books say very little.

A review of the development of both the cosmetic and the reparative plastic surgery of the head and neck, a description of the methods that have been and that are being used, would be timely. Such a study of the subject is being made by Drs. Gustav Tieck and H. Lyons Hunt, of New York, both experienced in this branch of surgery, and will be published, in serial form in the *JOURNAL*. The first article, an historical introduction, appears in this issue. The July article will consider keloids.

### Surgical Suggestions

In "gunshot" wounds of the thorax hemorrhage is much more apt to be from the lung than from the chest wall; and an intercostal artery, divided by the missile, rarely bleeds. In stab wounds of the chest, however, the intercostal vessels may bleed profusely.

In gunshot wounds of the chest, as Morelli has pointed out, if there is hemoptysis but no hemo- or pneumo-thorax the lung has been contused but not penetrated. Such a contusion of the lung is very serious, however, for it is apt to be followed by broncho-pneumonia, and this may be followed by lung abscess. Morelli succeeded in preventing abscesses, as he did in stopping pulmonary bleeding, by artificial pneumothorax, which compresses and immobilizes the lung.

In cases of fracture of a rib, it is necessary to watch the patient carefully for a couple of days to note the onset of a possible lung complication. Localized pneumonitis sometimes occurs.



## Progress in Surgery

Selections from Recent Literature

H. Lyons Hunt, M.D., L. R. C. S., Abstract Editor

**General Indications for Operative Exploration in Nerve Injuries.** HARRY PLATT, Manchester. *The Lancet*, April 16, 1921.

The writer states that from the serious consideration of this problem which is entering into surgical work at the present time, it is suggested that exploration, or re-exploration, should be considered under the following conditions:—

(1) In complete lesions of the median or ulnar nerves in the upper arm. The restoration of function in the proximal muscles is to be expected, even after long periods of delay, but the distal recovery may probably not take place. For lesions of those nerves in which conduction is already present as far as the proximal branches with the total failure of distal regeneration, exploration is on the whole advisable, but short of resection and suture, which may be unjustifiable, nothing can be done.

(2) In complete lesions of the median or ulnar nerves in the forearm. The potential restoration of sensation in the median is of such great importance as to warrant every effort to ensure its occurrence. In lesions of the median in which partial sensory conduction is present, but with complete motor loss, resection and suture at this date should be strongly condemned. For ulnar, where the intrinsic muscles are alone inactive, resection is always worth while.

(3) In all complete sciatic lesions where end-to-end suture can be reasonably expected.

(4) In musculo-spiral lesions exploration of the nerve should precede the performance of tendon transplantation.

**Alternative operations:** Although a technical consideration of those alternative operations for the restoration of function when nerve repair has been deliberately abandoned, or has failed to ensure conduction or function, is outside the scope of the present study, the question of the appropriate time and indications for their exhibition is one which is intimately concerned with the observations of the failures and successes of the suture operations.

Where the nerve lesion is declared to be irreparable after an exploratory operation the indication for the performance of an alternative operation is clear. But in the case of imperfect function following the incomplete restoration of conduction the role of the alternative operation cannot be so readily defined. Many of the operations performed under the latter heading have been premature and have been done early in the reconstructive surgery of the war when the normal prolonged stage of recovery of the injured or repaired nerve was not fully realised. The capacity for regeneration and ultimate function of the nerve after repair is apt to be minimised. Every surgeon who has lived close to this problem must have felt at times despondent. The immediate failures or late failures are easily explained and many of their causes can be avoided in the future. It is likely, from what has been seen of the behavior of the regenerating nerve, that after long periods of time, in a considerable number of instances, there will be well-marked recovery of the function. It is to be admitted, on the other hand, that to wait for future recovery of uncertain value is likely to be unsound. Again, the alternative operation itself may in no way jeopardise the recovery of the nerve, and therefore little harm can be done by its early performance. Few of the alternative operations have entered permanently into our surgical repertoire. In the upper limb these are, above all, the now classical operation of tendon transplantation for irreparable musculo-spiral injuries, the results of which are extremely gratifying; the simple tendon transplantations for restoration of flexion of the fingers or thumb in median and ulnar injuries; and in the lower limb the destructive operation of tenodesis of the ankle as an alternative to the lifelong wearing of apparatus. A new procedure has recently been added to the alternative operations which belongs to peripheral nerve surgery itself. This is the implantation of the proximal end of the radial nerve

into the median nerve at the wrist—an attempt to restore that lost sensory function in the median area which produces such a grave incapacity. This operation was introduced by Harris, of Toronto, and is supported by the report of one successful case. For the few irreparable lesion of the median nerve in the forearm, this operation may be worth a trial.

**A New Principle in the Surgical Treatment of "Congenital Cleft Palate," and its Mechanical Counterpart.** H. D. GILLIES, and W. KELSEY FRY. *British Medical Journal*, March 5, 1921.

Gillies thus summarizes the rationale of his procedure:

All unoperated hard palates have normal occlusion of the non-involved teeth.

Nearly all operated hard palates have abnormal occlusion of the non-involved teeth, (whether after Brophy, Lane or Langenbeck operation).

Nearly all operated palates have nasal intonation to speech and narrowed features and nasal passages.

Most unoperated adult cases have enjoyed good health.

Most palate cases require a dental plate, whether operated upon or not.

**Recommendations.**—(1) Suture soft palate as far back as possible in the pharynx by detachment from hard, making the hard palate defect greater; (2) fill the hard palate defect by appliance from earliest infancy, even at the bottle or breast stage.

**Time for Operation.**—Lip, early. Palate, before speech development or later.

Fry describes appliances (1) to aid feeding until time of operation; (2) to hold an epithelial inlay (to prevent the raw anterior edge of the newly made soft palate from scarring over and contracting forward); (3) to maintain the restored soft palate in position; (4) to restore the loss in the hard palate.

**Radium's Place in Therapy.** A. STRAUSS, Cleveland. *Ohio State Medical Journal*, May, 1921.

Strauss comments briefly on the various pathologic conditions in which radium is used and submits the following classification of affections amenable to radium therapy:—

**Group I**—In which radium is the method of choice.

1. Lymphosarcoma.
2. Hodgkin's Disease.
3. Sarcoma of the Extremities.
4. Fibromyomata of Uterus uncomplicated and not enlarged above the umbilicus.
5. Menorrhagias.
6. Carcinoma of the Cervix.
7. Carcinoma of the Face.
8. Obstructing Thymus in Infants.
9. Keloids
10. Epulis.
11. Nevus (Hemangioma).
12. Vernal Catarrh.

**Group II**—In which radium is to be used in conjunction with surgery.

1. Carcinoma of the Fundus of the Uterus.
2. Carcinoma of the Breast.
3. Carcinoma of the Prostrate.
4. Carcinoma of the Bladder.
5. Carcinoma of the Rectum.
6. Orbital Tumors.
7. Carcinoma of the Esophagus.
8. Carcinoma of the Jaw.
9. Carcinoma of the Tongue.
10. Carcinoma of the Lip.
11. Carcinoma of the Antrum.

**Group III**—In which radium has given relief but in which more experience is necessary before advocating its use above other methods.

1. Leukemia.
2. Corneal Ulcers.
3. Toxic Goiters.
4. Tumors of the Tonsils.
5. Tuberculous Adenitis.
6. Carcinoma of the Larynx.
7. Carcinoma of the Esophagus.
8. Leukoplakia.



Group IV—In which radium is only palliative.

1. Advanced inoperable growths.

Group V—Skin Diseases.

Psoriasis, pruritis, lichenification, chronic eczema, xeroderma pigmentosum, xanthoma and lupus erythematosus.—G. S. REITTER.

**Clinical Features as the Determining Factors in the Application of Radium and Roentgen Rays in Malignancy.** PAUL EISEN, Detroit. *Journal of the Michigan State Medical Society*, April, 1921.

The author states that great importance is attached to the physical and biological requirements that are attendant on the application of radium and x-ray treatments, but that the clinical features of malignancy are often overlooked. Yet the one factor that truly determines the amount of rays to be employed is the condition of the patient himself, i.e., his resistance to the malignancy.

The most important clinical feature to consider is whether or not the lesion is localized, and if it is a recurrent one, whether it is local at the site of the original growth.

The second feature of importance is to determine how rapidly the tumor is growing and what influence the rays have in checking the rate of growth.

A third factor is the origin of a cancer or sarcoma in its relation to amenability to the rays. Certain cancers of the bladder, tongue, vulva and some periosteal and chondrosarcomata are nearly always influenced by the rays. There is apparently some relation between the potential malignancy of a tumor and the amount of stroma at its base. A hard tumor with few cancer cells and a large amount of connective tissue is less radiosensitive than is a soft tumor with more cellular elements.

The age of the patient is of great importance. The older a patient is and the longer he has had cancer, the easier it is to attack it. Cachexia is a disastrous feature of malignancy.

Time element is of the utmost importance in destroying malignancy. In one case, the necessary amount of rays for a given time can be used, while in another, the patient's condition will not allow a full dose to be given at one sitting.

The combination of surgery and raying is recognized. Infection is to be avoided. Persistent pain is an ominous sign. Every effort should be made to conserve the blood supply. In the presence of toxic symptoms, raying should cease. The blood and urine should be under constant control.

In addition to the above clinical manifestations, Eisen recognizes the great importance of the patient's immunity against cancer. Just what factor reduces the acquired immunity of the patient is not yet known.—G. S. REITTER..

**Borderline Carcinoma of the Cervix and its Treatment.** EDWARD A. WEISS, Pittsburgh. *The American Journal of Obstetrics and Gynecology*, April, 1921.

A study of reports in recent literature shows that there is a decided inclination to abandon operative procedure in favor of radium therapy, and the immediate results by the use of radium are so favorable that this procedure seems justifiable. It should be remembered that radium has not been in use long enough by the large number of gynecologists to formulate a definite working technic, that too short a time has elapsed to speak of end-results in a large number of cases. The author has classified the cancers of the cervix into five groups. (1) Favorable cases localized to the vaginal portion of the cervix. (2) Early cancer of the cervical canal with no palpable extension to the parametrium. (3) Border-line cases—cancers with a moderate amount of tissue friability and fixation of adjacent structures, which fixation may be malignant or inflammatory in character. (4) Advanced cases, suitable for palliative treatment. (5) Advanced cases, not suitable for any treatment. Cancer of the cervix is still to be classed as an operative condition when discovered early and the patient is a good risk.

When a doubtful borderline condition is presented, treatment by radium is advisable and the question of subsequent operation should be determined by the reaction obtained; but if operation is contraindicated by age, general condition, heart, kidney, or bloodvessels, radium alone should be used.

A careful comparison between the cautery and radium type of treatment shows that both have advantages and disadvantages and that, in carefully selected borderline cases, far better results are obtained by a judicious combination of cautery amputation followed by moderate doses of radium.

The results in this small series of borderline cases, while generally satisfactory, are far from conclusive. The changing views on the subject are presented with the hope that other gynecologists of the society will tabulate their results, in order that the less experienced surgeons may formulate some definite plan of procedure in dealing with a diseased condition which heretofore has presented much difficulty. The wide range of radium dosage in treating cervical cancer, varying from 1500 mg. hours in some clinics to 8000 mg. hours in others, shows that no definite conclusions have been reached; and while favorable reports have been received from both extremes, the use of radium will be somewhat empirical. Definite conclusions can be drawn only after a careful tabulation of a long series of cases based on follow-up and end-results.

**The Treatment of Abortion Complicated by Sepsis,** GEORGE A. PECK, New Rochelle, N. Y. *The American Journal of Obstetrics and Gynecology*, April, 1921.

In considering the treatment of abortion complicated by sepsis, there are two schools, one believing that the products of pregnancy and the infected uterus should be removed, the other advising that the forceful removal of the infected products is productive of serious and unwarranted harm to the patient. For clearness of discussion, abortion is considered as any pre-viable expulsion of the human ovum, and if accompanied by a temperature of 101° F. (rectal) may be said to be accompanied by sepsis. The author believes in the conservative treatment of abortion complicated by sepsis as based on pathologic entities and clinical end-results. Hemorrhage is the only symptom which may demand a prompt emptying of the uterus for its control. Every intrauterine manipulation or procedure should be executed with the greatest care to avoid traumatizing and otherwise injuring the endometrium. Late cases, and especially those already subjected to curettement, are eminently suitable for this form of treatment.

**Fixation of the Ascending Colon.** (*Technique de la Fixation du Colon Droit—Colopexie en Equerre*). P. DUVAL and R. GRÉGORIE. *Presse Medicale*, March 23, 1921.

The authors describe their technique in detail, claiming very good results. Two illustrations are shown in which the principal steps of the operation are indicated. They make a triangular resection of the posterior peritoneum the length of the colon; the ascending colon is then sewed to the underlying tissues by interrupted sutures. In this way, the colon becomes densely adherent to the denuded tissues in a short time. If fixation of the transverse colon is also indicated, the same technique is used except that the anterior parietes are used, the colon finally being sutured to the abdominal wall.

**Penetrating Wounds of the Chest.** CLARENCE C. DEL MARCELLE, Neenah, Wis. *The Journal-Lancet*, April 25, 1921.

The author divides wounds of the chest into perforating, not sucking, and sucking wounds. The first class of case he treats with adhesive strapping and morphine gr. ¼ with atropine gr. 1-150, and the patient is put at rest for observation. Sucking wounds of the chest, when small are not necessarily dangerous. When large enough to admit air in quantities, they are exceedingly dangerous and cause considerable shock, mental and physical depression, and hemorrhage. If these wounds are packed with gauze, bleeding is seldom arrested, whereas if the chest wounds are pinned up with one, two, three, or more safety pins, which include the skin and as much of the muscle as possible, and then the dressing is applied, mortality is lessened.

This, of course, is an emergency treatment, to be applied for patients who arrive in the hospital. Later a débridement of the superficial wound is performed and deep mattress sutures are applied. The patients are put to bed in a sitting posture, and morphine, atropine, and anti-shock treatment administered.



The author concludes that early control of hemorrhage lessens mortality. The mortality rate in the first two hours was 14 percent, chiefly due to hemorrhage; mortality in patients seen later, 7 percent. The early diagnosis of hemothorax and early aspiration are of great importance. All cases of chest wounds do not require removal of foreign bodies.

**The Use of the Bronchoscope in the Diagnosis of Tumors of the Mediastinum,** JOHN D. KERNAN, New York. *New York State Journal of Medicine*, April, 1921.

The writer does not claim originality, but as all laryngologists do not use the bronchoscope, the information he imparts is new to some. The bronchoscope will not replace the x-ray and physical examination of the chest, but the bronchoscopic findings serve to fill out to a very great extent, the picture shaped by other methods, and occasionally make possible a diagnosis otherwise obscure. Kernan illustrates two points by x-ray and bronchoscopic appearances: first, that tumors affecting the trachea, esophagus, bronchi, pleura, larynx, thyroid gland, and heart, frequently make changes in the bronchoscopic appearance of the trachea and bronchi; second that the changes are in location and character more or less constant for the particular organ diseased.

Bronchoscopy and esophagoscopy, merely for examination purposes, are not difficult procedures. They can be mastered with a little practice, and certainly will pay for the trouble. They can be done in the office, though better in a hospital. They should be done under a thoroughly aseptic technic.

**Surgical Treatment of Angina Pectoris.** (*Traitement Chirurgical de l'Angine de Poitrine par la Resection du Sympathique Cervico-Thoracique*). T. JONNESCO (Bucarest) *Presse Medicale*, March 9, 1921.

The patient was a man of 38 who was both a luetic and alcohol and tobacco addict. Jonnesco resected the cervico-sympathetic on one side four years ago. There has been no recurrence of the original attacks since then. The cardiac condition, however, remains unchanged. The author is quite convinced of the relative ease and absolute harmlessness of this procedure and feels certain that the result obtained in the above case certainly indicates it in all similar cases.

**A Note on the Surgical Uses of the Fascia Lata,** CYRIL H. CUFF, Newcastle-on-Tyne. *The British Medical Journal*, April 2, 1921.

The author's conclusions are based on the uses made by the fascia lata in the repair of many lesions received during the war. He gives the following indications:

1. In the repair of, or as a substitute for, tendons and ligaments:

- (a) Injuries in which there is loss of tendon substance, recent or old standing.
- (b) In lieu of dividing and transplanting a healthy tendon, in order to reinforce a paralyzed one, connecting these two by a facial intermediary tendon.
- (c) As a substitute for intrinsic or extrinsic articular ligaments—for example, the crucial (Hey Groves) and the internal lateral ligaments of the knee.
- (d) As an auxiliary ligament—for example, in lieu of tendon fixation for a "dropped" foot—a Y-shaped fascial ligament may be employed; or in recurrent dislocation of the shoulder a facial "sling" passed through the quadrilateral space may be used, or it may be passed through a hole drilled in the head of the humerus and the acromion process.

2. For clothing an area which has been deprived of its normal covering tissue.

- (a) After the excision of adherent scars.
- (a) In the abdomen, after extensive resections of the colon, to aid in "peritonization."
- (c) In arthroplasties, interposed between the two raw bony surfaces (Murphy).
- (d) As a sheath to protect a nerve suture.
- (e) In gunshot or other injuries of the skull, where there has been extensive loss of bone and dura mater prior to bone grafting.

3. To reinforce defects in the parietes of the chest, the abdomen, and of vessels.

- (a) To cover in a lateral defect in a vessel wall.
- (b) In repair of the urethra, after excision of stricture.
- (c) In closure of fecal fistulae and ventral hernia, where parietes are deficient.
- (d) In reconstruction of an intercostal space in hernia of the lung.

**Physical Therapeutics from the Surgical Standpoint.** J. STUART ROSS, Tynecastle. *Edinburgh Medical Journal*, April, 1921.

From the point of view of remedial as apart from operative treatment, we have to do in essence with four conditions. (a) Fibrositis and resulting deformities, such as take place in muscles, ligaments, and scars. (b) Loss of power in one or more muscles, due to scars, paralysis, or faulty cerebration. (c) Nerve injuries. (d) Persistent sinuses or other unhealed wounds.

Among the remedial measure the first place is given to massage for the following reasons:—It (a) removes the products of inflammation; (b) improves circulation; (c) relieves pain of a neuritic or rheumatic type; (d) breaks down adhesions; (e) relaxes muscle spasm.

Under exercises, which is next taken up, the author prefers passive movement. In dealing with muscles, there is much more than mere mechanics to consider. Swedish remedial exercises are advocated in certain cases if guided by sound medical advice.

Electrical treatment. Only two forms, galvanism and faradism, and an occasional sinusoidal current, are to be regularly recommended. Diathermy is one of the most striking of all physical methods. Thermo- and photo-therapy render the part in ideal condition for massage or passive movements. Graduated splintage is essential in the late stages of injuries such as are seen in pensions work today.

**The Treatment of Intranasal Suppuration.** E. ROSS FAULKNER, New York City. *New York State Journal of Medicine*, April, 1921.

The treatment of intranasal sinus disease falls naturally into two subdivisions, operative and non-operative. In suppurative conditions, it is essential to promote free drainage, and this is difficult to attain in the various intranasal sinuses. As the natural drainage openings are not placed in a dependent position, when any inflammatory process occurs, the natural drainage is apt to become occluded, causing acute sinusitis. It is essential, therefore, that the first principle of treatment should be directed toward emptying the cavities of their secretion.

The writer tabulates indications for operation of sinuses based on clinical symptoms as follows: (1) Certain acute cases with very severe, persistent pain and high temperature, or symptoms pointing to extension to the orbit or cranial cavity. (2) Chronic cases with profuse purulent discharge which will not clear up on treatment. (3) Cases with slight discharge, but with frequent acute exacerbations, with chronic headache and malaise. (4) Cases with ozena. (5) Cases with nasal obstruction due to polypi, especially if associated with asthma. (6) Cases where suppuration in sinuses acts as a focal infection usually manifested by eye or joint symptoms. (7) Cases with involvement of nerves, proximal to the sphenoid and posterior ethmoid sinuses. The nerves most commonly affected are the optic or sixth, but the third, fourth or fifth may sometimes be involved. (8) Cases with signs of extension to the orbit, or cranial cavity, or with an external fistula indicating necrosis. (9) Cases with the mucocele either causing nasal obstruction or pointing externally.

**An Exceptional Cause of the Retro-Parotid Syndrome.** (*Une Cause exceptionnelle des Syndromes Retro-Parotidiens*). E. CHABROL L. DUFOURMENIEL and MICHEL. *Paris Medicale*, March 12, 1920.

The authors report a case of tonsillar abscess which gradually subsided under the usual expectant treatment. In a week, however, a phlegmonous angina developed, gradually spreading until a typical retro-parotid syndrome was present. The ninth, tenth, eleventh and twelve cranial nerves were all involved, complete atrophy occurring. The sympathetic, however, was not involved. The disturbances in



swallowing were so severe that the patient soon died of inanition.

The case is reported to show how dangerous a tonsillar abscess can be and with what fatal results the inflammation can proceed. It is therefore imperative to treat all tonsillar abscesses surgically as early as possible.

#### Recurrent Hernia: the Operations for its Cure, A. W. SHEEN, Cardiff, *The Lancet*, April 9, 1921.

After having operated upon a number of cases of recurrent hernia, the author deduces that the cause of recurrence in indirect hernia is the non-removal of the deeper part of the sac; that an occasional cause may be a small sac not having been found; other recurrences are those of direct hernia; that in a few cases an original indirect hernia has been cured, but a direct hernia has been present at the original operation or has developed subsequently.

To operate for hernia, the writer first seeks for the sac in the region of the internal ring. After reaching the external oblique aponeurosis, it is incised from the external ring  $\frac{3}{4}$  inch and retracted. The cord coverings are next opened, close to where the internal oblique edge crosses over the cord, and the internal oblique divided in the line of the canal outwards for about an inch. A sac, if present, is found and the outermost part of its neck reached without any retraction. The sac is then followed down and isolated by splitting the coverings and dissecting them off. The sac is then opened and the finger passed inside, and hooked round on the peritoneal surface, and its point pushed forward against the peritoneum and transversalis fascia on the inner side of the deep epigastric vessels, thereby demonstrating a direct hernia if present and its size, and feeling the width of the gap between the conjoined tendon and Poupart's ligament. The appendix can now often be removed on the right side through the sac opening. Lipomata are removed. Where there is an indirect, and no direct hernia, the operation is continued by removing the sac flush with the parietal peritoneum (taking care to go deeper than any circular white thickening on its interior wall) and closing the peritoneal wound. Then the cut internal oblique and the coverings of the cord are sutured, the internal oblique and the conjoined tendon drawn down to Poupart's ligament as an additional safeguard, and the external oblique closed. The cord is as little interfered with as possible, and remains in its natural position.

#### How May We Reduce the Mortality in Appendicitis?

MAURICE KAHN, Los Angeles *Medical Record*, April 30, 1921.

The author, after quoting statistics of Patterson, Kakels, Turner, Wood, and Morph, records 307 cases to show the high rate of mortality in late cases. Ninety-three cases were acute, average time 24 hours, with no deaths; 19 cases, local peritonitis, 30 hours, no death; 74 cases gangrenous, 38 hours, no death; 35 cases, diseased appendix,  $3\frac{1}{2}$  days, 6 deaths; 86 cases, abscess,  $4\frac{1}{2}$  days, 3 deaths. One hundred of these patients give the history of having had one or more previous attacks. The surgeon is not culpable, but acquits himself creditably if given a fair trial. Procrastination which permits a case to develop complications, is the cause of death in this disease. When a case of appendicitis has progressed to the state of abscess, the indications are that someone has mismanaged. The diagnosis is frequently missed in its early stages, because the general practitioner sees many cases of indigestion and comparatively few of appendicitis, so the habit develops of assuming cases of abdominal pain to be simple, until proven serious. In summarizing, the author states that there is only one treatment for appendicitis,—surgery. Inasmuch as the progress of a given case defies prophesy, there is only one time to operate—immediately following diagnosis. Reliable statistics show a mortality of from 10 to 20 per cent in appendicitis. Sixty percent are early cases in which the infection is within the confines of the appendix, and there are practically no deaths. Forty percent of those operated upon are late cases, after the infection has spread beyond the confines of the appendix, and it is this class which gives us our mortality. The present high mortality could be greatly reduced by timely intervention, but early diagnosis is essential in order that early operation may be performed.

## Book Reviews

**Plastic Surgery of the Face, Based on Selected Cases of War Injuries of the Face, including Burns.** By H. D. GILLIES, C.B.E., F. R. C. S., Major R.A.M.C., Surgical Specialist to the Queen's Hospital, Sidcup; Surgeon in Charge of the Department for Plastic Surgery; and Late Surgeon in Charge of the Ear, Nose and Throat Department, Prince of Wales's Hospital, Tottenham; Late Chief Clinical Assistant, Throat Department, St. Bartholomew's Hospital; Hon. Fellow, National Dental Society of America. With Chapters on the *Prosthetic Problems of Plastic Surgery* by CAPT W. KELSEY FRY, M.C., R.A.M.C., Senior Dental Surgeon, Queen's Hospital, Sidcup; Senior Demonstrator and Dental Officer in Charge of the Prosthetic and Metallurgical Department, Guy's Hospital; and Remarks on Anesthesia by CAPT. R. WADE, R.A.M.C., Late Senior Anesthetist, Queen's Hospital; Assistant Anesthetist, St. Bartholomew's Hospital; Anesthetist, Great Northern Central Hospital. Quarto; 400 pages; 844 illustrations. London: HENRY FROWDE, HODDER AND STOUGHTON, 1920.

The war has given us many excellent monographs and books on facial plastic and reconstructive surgery, in English, French and German. Some of these, like this remarkable work of Gillies' have come from that brilliant galaxy of workers at the Queen's Hospital at Sidcup, where these cases were largely segregated from the British and Dominion Armies. But of the various books on the repair of maxillo-facial injuries that have come to our notice none compares with this splendid work.

It is not written in the familiar form of a treatise, and yet it contains all that—and more than—such a treatise would be expected to comprise. But a few pages (Chapter I) are devoted to the general discussion of *Principles*. All the rest is a beautiful atlas, and detailed description, of selected cases. It is in the reports of these cases, recording, as they do, all the many problems—mechanical and surgical—that arise in facial mutilations, and the procedures, successful and unsuccessful, by which they were met, that are unfolded the details by which the principles of Gillies' methods are applied. These details are conveyed to the reader not merely by description and by the photographs; wherever necessary line drawings are also introduced to illustrate the plan of operation. Of the splendid photographs themselves, demonstrating the progress of the cases from their outset, through various stages to the end-result, too much cannot be said in praise. The work of a non-commissioned officer, they were taken with pains to show, and not to conceal, disfigurement, and are reproduced without retouching. In very many of these cases the injury was so extensive, so repulsively mutilating, that the manufacture of shapely, living features would seem well-nigh impossible. Even in these, the results are truly wonderful, the photographs amply testifying to the surgical wizardry of this master of the plastic art.

The cases are grouped to illustrate the various problems in mutilations of the cheek, the lips, the chin, the upper and the lower jaw, the nose, the eye regions, the ear. Gillies describes several plastic procedures, with neighboring flaps, with the auricle itself and with implantation of shaped rib cartilages, in restoring deformities of the pinna. This section is brief, however; Gillies remarks that "defects and burns of the pinna form a small proportion of facial injuries" and "the ear defect in a severe burn is a minor part of the disfigurement and does not usually justify the time and trouble that its cure requires". There is a well-considered chapter on *Prosthetic Appliances in Relation to Plastic Surgery*, as they concern the replacement of large bony and dental losses in the mouth and the temporary support of flaps for the restoration of the nose or of "epithelial inlays" for the orbit. The employment of these prostheses is further described in the case reports. The concluding chapter on *Plastic Surgery in Civil Cases* is very



brief but highly suggestive. It indicates the possibilities of the methods employed in facial restoration for contractures, large ulcers, rebellious urethral stricture, imperforate anus, extrophy of the bladder, etc.

Several advances in plastic surgical methods were developed by Gillies and his co-workers at the Queen's Hospital, and Gillies himself originated the very important and highly useful "tubed pedicle", the "epithelial outlay" (an adaptation of Esser's "epithelial inlay" to surface use, as in the cure of ectropion), and the employment, to replace extensive loss of ascending and horizontal rami of the mandible, of the seventh or eighth rib on the opposite side and its attached cartilage—replacing the angle of the jaw by the angle in the cartilage and effecting a false joint in the glenoid region, thus form and function both being restored.

So fascinating is this work, and so well written, that one might be tempted to read it through steadily. That would be a mistake; each case description is so full of "meat", so replete with important details, that the volume should be read slowly, intermittently, and "digested" thoughtfully.

We know of no more valuable contribution to the book literature of recent surgery than Major Gillies' "Plastic Surgery of the Face."

**Operative Gynecology.** By HARRY STURGEON CROSSEN, M.D., F.A.C.S., Associate in Gynecology, Washington University Medical School, and Associate Gynecologist to the Barnes Hospital; Gynecologist to St. Luke's Hospital, St. Louis Maternity Hospital, and Bethesda Hospital; Fellow of the American Gynecological Society and of the American Association of Obstetricians and Gynecologists. *Second Edition.* Royal octavo; 717 pages; 834 illustrations. St. Louis: C. V. Mosby Company, 1920.

In reviewing the first edition of this admirable work (the JOURNAL, August, 1915), we referred to its excellent features, pictorial and textual. We know no work in English that is a better guide in the technics of individual gynecologic operations and in the selection of operation according to indications, that is to say, the adaptation of the surgical procedure to the pathological conditions. An important feature of that edition was the classification, on these lines, of the various operations for retrodisplacement of the uterus.

In the second edition Crossen has similarly classified the operations for prolapse, describing them under anatomical terms rather than by the name or names of their originators or modifiers.

The work has been brought quite up-to-date. It is enriched by over 60 new illustrations, nearly all of them, like most of the others, the excellent work of Mr. Ivan F. Summers.

**The American Illustrated Medical Dictionary.** By W. A. NEWMAN DORLAND, A.M., M.D., F.A.C.S., Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association; Editor of "American Pocket Medical Dictionary." *Tenth Edition.* Royal octavo; 1201 pages; flexible cover. Philadelphia and London: W. B. SAUNDERS COMPANY, 1921.

The nomenclature and terminology of the arts and sciences undergo a more or less steady growth and alteration. This is especially true in medicine, an ever-developing science that draws so largely from all the other sciences. Our dictionaries, therefore, need to be revised frequently to keep them, for a time, complete and up-to-date. Thus Dorland's standard dictionary, which has been reprinted very often, has been revised nine times in twenty years.

This tenth edition defines several hundred new terms, and many other definitions and descriptions have been amplified. An extremely valuable feature of the dictionary is to be found in the historical notes. Thus, after many terms, eponymic and otherwise, is a parenthetical note of the name of the inventor or discoverer or, in other cases, of the originator of the term. These historical references, and other contributions to the work, were supplied by Dr. Fielding H. Garrison, the well-known medical historian and bibliographer.

Another very useful feature, not, however, new in this edition nor unfamiliar to other medical dictionaries, is the collection under single headings, in the form of tables or

descriptions or classifications, of much collateral information. There are about 150 such headings whereunder are grouped large numbers of correlated data.

**Roentgen Interpretation, A Manual for Students and Practitioners.** By GEORGE W. HOLMES, M.D., Roentgenologist to the Massachusetts General Hospital and Instructor in Roentgenology, Harvard Medical School, and HOWARD E. RUGGLES, M.D., Roentgenologist to the University of California Hospital and Clinical Professor of Roentgenology, University of California Medical School. *Second Edition.* Octavo; 228 pages; 184 illustrations. Philadelphia and New York: LEA & FEBIGER, 1921.

When the first edition of this work appeared two years ago we welcomed it as an admirable manual, a reliable guide. It is not exhaustive; on the contrary, it is a condensed presentation of the salient factors in roentgen diagnosis.

This edition shows no extensive changes. Although enlarged by about twenty pages it is still, in form and in substance, a convenient manual, a handy book for rapid reference. The revision has been largely in the introduction of new matter. For example, in the chapter on Bone Pathology there have been added paragraphs on *chloroma*, *Kochler's disease*, *hypertrophic pulmonary osteoarthropathy*, *halisteresis* (bone atrophy), and *changes associated with nerve lesions*. The bibliography of bone lesions has also been much enlarged. Good as this chapter is, it deserved more space in which to describe the roentgenoscopic differentiation between, for example, chronic osteomyelitis of pyogenic origin, in its various aspects, and chronic bone syphilis, between gumma and sarcoma of the bone, between benign bone cysts and malignant neoplasms, the reading of the shadow in syphilitic periostitis, pyogenic osteo-periostitis, and early periosteal sarcoma, etc. The roentgenogram of a syphilitic dactylitis (fig. 39) should have been contrasted with one of a spina ventosa. Bone abscess is mentioned but in passing, without illustrations and with insufficient description of causation, varieties and recognition. The paragraph on typhoid bone infection is also too brief: neither the "shirt-stud" nor the deeper typhoid abscess is referred to. One cannot provide an insight into the interpretation of roentgenograms of various phases of chronic osteomyelitis in three brief paragraphs. We have discussed this chapter especially because it seems a pity that in so well-conceived and useful a work on Roentgen Interpretation more space was not devoted to the differential diagnosis of bone lesions. The roentgen interpretation of bone lesions is often as delicate as it is important, and serious mistakes are not seldom made. The addition to this chapter of ten or twenty pages describing more in detail the reaction of the periosteum, the bone cortex, the medulla, the epiphysis, to various lesions, and contrasting, by description and by illustration, these reactions from the standpoint of differential diagnosis, would make of this chapter what it falls short of being. It is evident that the authors sought to produce neither a treatise nor an atlas, but they might expand their work a bit in the direction we have indicated and still keep it a manual.

**Electro-Therapeutics for Practitioners, Being Essays on Some Useful Forms of Electrical Apparatus and on Some Diseases which are Amenable to Electrical Treatment.** By FRANCIS HOWARD HUMPHRIS, M.D. (Brux), F.R.C.P. (Edin); M.R.C.S. (Eng), L.R.C.P. (London), L.M. (Rot. Dublin), D.M.R.E. (Cantab), Late Officer in Charge X-ray and Electro-Therapeutics Department, 3rd London General Hospital; Captain, R.A.M.C. (T.F.) etc. *Second Edition.* Small octavo; 300 pages; illustrated. London: HENRY FROWDE; HODDER & STOUGHTON, 1921.

There is a common sense attitude pervading this volume which gives it a special value to general practitioners. There is no "claim everything" policy, but a reasonable presentation of theories and results. Considerable new material has been introduced and there has been a marked expansion of the field of discussion through rewriting various chapters and bringing them up to date.

This is far from being a text-book, but it is a useful volume on indications for electro-therapeutics.



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## IMPROVEMENT IN THE VARIOUS METHODS OF LOCAL ANESTHESIA FOR EXTENSIVE ABDOMINAL OPERATIONS.

PROFESSOR DR. HANS FINSTERER,

VIENNA.

Since the introduction of the employment of novocain and epinephrin (adrenalin) by Braun, local anesthesia has spread more and more in Germany and Austria. Of abdominal operations only such as gastrotomy and jejunostomy used to be performed under local anesthesia. But that very large and difficult abdominal operations, such as extensive stomach and intestinal resections, can be performed entirely without general narcosis by the present technic of local anesthesia, that just in these severe operations the exclusion of general narcosis may be downright decisive for the further course, is probably but little known as yet. In Germany but very few absolute adherents of this method have been found. Among them are Braun, Hackenbruch, and Reinhard. I do not know whether as yet local anesthesia is employed in America and England in the severe abdominal operations. According to statements by Wiener of New York this does not seem to be the case, since he points out as great progress of late years that appendicitis operations may be performed under local anesthesia.

Local anesthesia is far superior to general narcosis for the mere reason *that the contraindications to narcosis* which held good heretofore and because thereof to the operation itself, namely, severe affections of the heart and lungs, advanced age and progressive cachexia are of no importance in local anesthesia so that we can still operate upon patients for whom every physician must decline an operation under general narcosis. This means that with the systematic improvement of local anesthesia its field of usefulness can be greatly enlarged.

In order to bring about complete painlessness in abdominal operations it is absolutely necessary to follow the technic of local anesthesia exactly. On the basis of my own experience in more than fifteen hundred laparotomies performed by me under local

anesthesia, I can but confirm the statements elsewhere in regard to similar operations by Lennander, Kappis, and others. The opening and suturing of the peritoneum of the anterior abdominal wall is the most painful part of the operation. It is therefore absolutely necessary to avoid this pain, and this can be achieved, as for example in laparotomy of the upper abdominal region, by making the abdominal walls insensible to pain with fan-shaped injections of a half per cent. solution of novocain on the outer margin of the rectus. The infiltration of the section surface alone does not suffice, because the pressure of the abdominal spatula on the lateral portion of the already sensitive peritoneum causes pain. In all laparotomies, therefore, the conducting nerves must be blocked at least a hand's breadth centrally from the incision by an exact conducting anesthesia.

The touching and squeezing of stomach and intestines are painless if pulling of the mesentery is avoided. The mesentery itself contains pain-conducting nerves, therefore this also must be blocked by novocain.

In order to carry out a stomach resection actually without pain we must, besides an exact conducting anesthesia of the abdominal walls, inject a novocain solution of thirty to forty cubic centimeters at the base of the small omentum into the ligamentum hepato-duodenale, at the base of the mesocolon transversum, in the peritoneal transit of the pancreas. For a resection of the small intestines the injection is made at the base of the mesentery. As the stomach, the small intestine and the gall-bladder are supplied by the nervi splanchnici, these can be made insensible by an injection of seventy to one hundred cubic centimeters of a one-half per cent. novocain solution on the anterior surface of the twelfth thoracic vertebra (splanchnicus anesthesia according to Braun). By an exact conducting anesthesia, stomach resections may be performed absolutely without pain and without the slightest help of ether. In my 157 stomach resections for cancer I performed more than two-thirds under pure local anesthesia, therefore without the slightest help of ether. In the remaining cases, particularly in long operations taking three hours, the amount of ether was only twenty to one hundred



cubic centimeters.\* The amount of ether possibly necessary is so trifling that even in chronic pulmonary affections it is of no significance.

In the urgent operations for intestinal obstruction, or peritonitis, the indications for local anesthesia may be considerably enlarged. As in such affections a paralysis of the vasomotor nerve is present, and consequently a diminution of blood pressure, we must avoid any further decrease of the blood pressure ending in a collapse. Therefore we may employ neither chloroform nor a deep ether narcosis, as these would decrease the blood pressure. But in these affections the central application of novocain in the form of lumbar anesthesia or of paravertebral conducting anesthesia is contraindicated, as either may lead to diminution of the blood pressure and therewith to collapse. In these operations I consider an exact conducting anesthesia of the abdominal walls for the opening of the abdomen combined with a short ether narcosis for the purpose of finding the cause of the intestinal occlusion, as the best anesthesia, because the blood pressure is not diminished thereby, but, on the contrary, the ether narcosis raises the blood pressure which is diminished by the eventration of the intestinal loops. In this way I was able in a case of volvulus of the flexura sigmoidea in spite of the very bad general condition (pulse one hundred and sixty, scarcely perceptible, cold perspiration, cyanosis) to successfully perform the resection of the enormously large already gangrenous flexure which contained ten liters, with subsequent circular intestinal suture.

A woman, seventy-one years old, came for an operation fifteen hours after perforation of an ulcer duodeni and diffuse peritonitis; her pulse was irregular and could be made palpable only after an intravenous infusion of physiological salt solution and adrenalin. I performed this operation under local anesthesia, together with 10 cc. of ether, which was given drop after drop only as a stimulant. The operation was: suturing over the perforation in the duodenum, exclusion of the pylorus and posterior gastro-enterostomy, irrigation of the abdomen with large quantities of physiological salt solution. The patient not only underwent the operation exceedingly well in spite of her generally bad condition, but she is still, three years since the operation, in complete health. I could add many instances which go to show that

with this kind of anesthesia we need not decline any such operations.

The use of local anesthesia favorably influences the post-operative course also. As long as eight years ago I was able to make the assertion in one of my works that the cases of death of so-called operation shock, which is to be interpreted only as protracted narcosis effect, can be entirely avoided, and that the post-operative stomach and intestinal atonies with secondary stomach dilatation and peritonitis are almost wholly missing. I can now, on the basis of more than fifteen hundred laparotomies under local anesthesia, fully confirm this important fact. I have among my 157 resections for cancer of the stomach and 279 for ulcer as yet had no case of death in immediate connection with the operation, that is, of so-called operation shock, though there were cases where the body-weight was less than thirty kilograms. Hackenbruch and Reinhard have also confirmed the fact that the post-operative course even after the severest operations is quite unusually good.

By local anesthesia the fatal lung complications are also almost entirely avoided. I myself have no case to record of death from post-operative pneumonia among my stomach resections for ulcer. Among them are 28 cases of patients between sixty and seventy-six years of age who mostly suffered from severe chronic bronchitis and emphysema before the operation. All these 28 cases were cured without any complication. As a matter of course, old people must be constantly encouraged to clear their lungs in spite of the pain, so that no retention pneumonias may develop as consequences of bronchitis. In the resections for cancer of the stomach, to be sure, I had five cases of death from lobular retention pneumonias; but this is easily explained by my liberal attitude toward indication for resection in cases of cancer, even in high-grade cachexia and great age, so that the patients are no longer strong enough to clear their lungs. As neither heart nor lungs are injured by a narcotic, the patient—should it actually come to a broncho-pneumonia (from rapid cooling off in the operation room)—get over it more easily since the prognosis of this disease depends chiefly on the endurance of the heart action.

The exclusion of general narcosis will enable us to achieve considerably better results in the major abdominal operations. While, for instance, in cancer of the stomach resection has hitherto shown a mortality of twenty to thirty per cent., even with careful selection of the cases, I have a mortality of only 17.4

\*In penetrating stomach ulcers which in themselves are exceedingly painful, the resection under local anesthesia alone is also possible, but the number of cases in which some ether had to be given for mobilization of the stomach was greater than in cancer (more than half of the cases). Since we use splanchnicus anesthesia this help from ether has become superfluous.



per cent. among my 157 cancer resections. Here it must be noted, too, that, contrary to the former standpoint, I have resected in cases of liver metastases and ascites on account of the hemorrhage and ichorous suppuration, and that a spread of the cancer to the oesophagus and to the pancreas and liver has not deterred me from the resection. Therefore the number of resections is considerably greater than that of the gastro-enterostomies (157 resections, 59 gastro-enterostomies, 51 exploratory laparotomies). After exclusion of the no longer radically operable cancers, which are everywhere excluded from operation, the mortality among my resections amounts only to 8.3 per cent. Whether a cancer is still operable can, excepting in demonstrated liver metastases and ascitis, be decided only by laparotomy. Therefore this should be performed under local anesthesia, which is completely without danger, in every case. Three years ago in a woman seventy years old who had had a cancer diagnosed six months previously, but the operation considered impossible on account of her age, I extirpated almost the whole stomach with complete success. Many such a similar case might be mentioned. Since the introduction of local anesthesia we are in duty bound to perform exploratory laparotomy in every justified suspicion of cancer so that we can operate upon it as early as possible.

Resection in case of *stomach and duodenal ulcer* has considerably better results. Although, without exception, I performed resection in all cases, even when the patient was very old and greatly emaciated (twenty-nine kilos), the immediate mortality in 279 resections was only 6.7 per cent. Even of the resections for *ulcus duodeni*, an operation which is still declined by many surgeons as too difficult and dangerous, I have to record a mortality of 4.5 per cent. among 132 cases, which for the last two and one-half years has, by additional experience, been reduced to 1.2 per cent among 84 cases. Of these there are several cases I would mention, for instance, that of a very cachectic woman of sixty four and one of seventy-two, whom physicians who operate only under complete narcosis had refused operation, yet in whom I performed the resection under local anesthesia. The operation was completely successful in both cases and ran a better course than in an ordinary gastro-enterostomy under complete narcosis.

In cases of resections performed at the stage of *stomach and duodenal hemorrhages dangerous to life* we must be very cautious with the quantity of novocain. Only one-quarter per cent. solutions, instead of one-half per cent. should be used, because the usual novocain doses would prove dangerous for

patients deprived of so much blood. With observance of such careful measures very good results may be achieved, even despite hemorrhages of long standing and very severe anemias (pulse no longer palpable at the wrist). Until now I have had only two cases of death to record in 19 resections on account of severest hemorrhages from stomach and duodenal ulcers, that is 10.5 per cent. mortality. This is certainly a very good result if it be considered that almost all these cases had been previously treated internally without success and had finally been sent for operation in a dying state.

Extensive intestinal operations also, even at advanced age, become almost harmless operations. Among 46 resections of the *small intestine* I had 14 patients aged sixty to eighty-two, of whom only one died, a woman sixty-five years old with incarcerated umbilical hernia, intestinal gangrene, phlegmonous inflammation of the hernial sac and diffuse peritonitis. All the other cases came to a cure without complications. In the severe umbilical hernias of stout women it is absolutely necessary to apply only a one-quarter per cent. instead of one-half per cent. solution of novocain on account of the large quantities of fluid.

*Resection of the large intestine* with subsequent suture can be performed with perfect precision because the local anesthesia leaves us unlimited time for the three layer button suture which is bound to hold absolutely. I myself have had only 4 deaths among 59 primary resections of the large intestine with suture, a mortality of 6.3 per cent. But even in these cases the sutures remained completely firm. In comparison with previous results of resection of the large intestine (twenty to thirty per cent. mortality), those under local anesthesia are to be designated as very good. Reichel also points out the advantages of local anesthesia for suture of the large intestine (14 resections of the large intestine under local anesthesia without any death).

For resections of the large intestine paravertebral conducting anesthesia (injection from the tenth dorsal nerve to the third lumbar nerve bilaterally) may be advantageously applied. In local anesthesia of the abdominal walls alone and subsequent infiltration of the mesocolon a little ether may possibly become necessary at the moment of mobilization.

For the past six years I have performed nearly all operations for *appendicitis* under local anesthesia. Information as to the proper technic to be found in the *Medizinische Klinik*, 1917. Of 226 interval operations, 88 per cent. could be performed entirely under local anesthesia. In the remaining cases a little ether



(up to twenty cc.) was necessary for detaching the severe adhesions present. All the cases healed without complications. I employ local anesthesia in cases of *acute appendicitis* also; however, a little ether in thirty per cent. of the cases must be used as a help. The results are very good. In 185 cases, among them 74 perforations of the appendix and circumscribed peritonitis beneath the transverse colon, I have only one death to record, from pulmonary embolus on the sixth day after the operation, resulting from a thrombosis of the left vena hypogastrica. Therefore, the mortality in acute appendicitis amounts to only 0.5 per cent.

In *diffuse peritonitis* also, when suppuration can already be demonstrated above the transverse colon between liver and diaphragm, the favorable influence of local anesthesia shows. While of 7 cases of former years operated under Billroth narcosis 6 died, and of 8 cases of peritonitis under ether narcosis 4 died, I have to record only 3 deaths among my latest 19 cases of peritonitis. In my opinion the explanation of this surprising fact is, first, that the intestinal paralysis caused by the affection is not intensified as under general narcosis, particularly chloroform narcosis, and, second, that the severe injuries to the liver that may be observed (according to Spengel) just in the acute abdominal affections in connection with chloroform narcoses, are entirely absent. For the six years that I have occupied an independent position I have had altogether one death, the one above-mentioned of pulmonary embolus, among 156 cases of acute appendicitis including 9 cases of diffuse peritonitis. I ascribe these excellent results chiefly to the omission of deep general narcosis.

The extirpation of the *gall-bladder* may likewise be performed under local anesthesia. To be sure, for this an exact local anesthesia of the peritoneum of the posterior abdominal wall is necessary, which is best done by the splanchnic anesthesia, according to Kappis or Braun. In conducting anesthesia of the abdominal walls and infiltration of the ligamentum hepato-duodenale, a little ether (30 to 50cc.) is necessary under certain conditions. The assertion of internists that the removal of the gall-bladder is still a very dangerous operation on account of the numerous deaths immediately following is no longer quite true, particularly with local anesthesia. I myself have had not a single case of death immediately after the operation, although, to be sure, my material was small, 104 cases. Here also it is of great importance that even the smallest quantities of chloroform, as in the Billroth mixture for instance, be excluded

since, according to Spengel, the smallest quantities suffice to cause a fatally acute atrophy of the liver.

The instances mentioned surely prove that the results of even the severe abdominal operations may be greatly improved by the application of local anesthesia. Therefore it is the task of scientific research to further perfect the methods of local anesthesia by discovering new, less poisonous and more effective means than novocain. The combination of quinine and urea hydrochlorid, employed abroad and alleged to produce anesthesia protracted up to ten days seems to me to be effective with injection at the section surface, but not for a conducting anesthesia. In my experiments prior to 1914 with this combination I was not able to produce complete anesthesia during the operation. Therefore further experiments are necessary to show whether this preparation will prove better as an anesthetic than novocain.

## COMPLETE PROLAPSE OF THE RECTUM.

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### MECHANISM.

Complete prolapse of the rectum consists in the descent of all of the coats of the rectum and is a far more serious condition than the partial variety because of the invalidism which it induces as well as the complications which are ever present. In this variety the mucous membrane is in its normal relation to the other coats of the bowel, but the entire rectum is protruded from the anus and has lost its normal relationship to the other pelvic viscera.

Two different types of pathological change contribute to procidentia:—

1. Extreme mobility of the rectum and the elongation of its supports may be the result of imperfect prenatal fixation or of traumatic conditions, either of which permit of constant dragging of the rectal attachments and supports. The intra-abdominal pressure exerted at stool is applied to the recto-sacral ligaments.

Quenü, quoted by Lynch, says: "The uterus and rectum have a common means of suspension; therefore any cause bringing about the fall of one endangers the fixity of the other. Hysterectomy deprives the rectum of the anterior support afforded it normally by the uterus. The weakening of the pelvic floor favors the prolapse of both of these organs".

The pelvic cavity is funnel-shaped and from its lower opening protrudes the rectum, held in place



by the peri-rectal areolar tissue and fascia, the levator ani, the recto-coccygei, and the two sphincter muscles which are interleaved or woven into the pelvic fascia.

The pelvic fascia is a continuation of the lumbar, iliac and transversalis fasciae and supports the abdominal contents from below. It is attached to the bony framework of the pelvis; in front to the inner surface of the pubic bone; on the sides, to the ilio-pectineal line; posteriorly, just above the attachment of the pyriformis, and to the anterior surface of the sacrum; and thus it binds the pelvic organs firmly together. From this level the fascia dips down between the pelvic organs, forming the obturator fascia and the recto-vesical fascia, covering the levator muscle and also forming the deep layer of the triangular ligament. These structures form the true pelvic floor, but from these are projected extensions between and about all the pelvic organs which become accessory ligaments of these organs. The true pelvic floor is a fixed structure, but the fascial branches between these organs are suspensory stays allowing considerable play. It is these rectal stays which offer the resistance during the straining at stool which is necessary to prevent displacement of the rectum. When these stays become flabby from repeated or excessive stretching, they lose their contractile power and the organ they support drops away. A lacerated perineum destroys the fascia holding the rectum to the levator ani, and the powerful intra-rectal pressure soon pushes the rectal wall into the vaginal outlet. The protrusion in turn tends to further relax the musculo-fibrous structures.

2. In other cases a defect in the pelvic fascia permits a hernia of the pelvic bowel. This defect may sometimes be developmental.

In early embryological life the peritoneal pouch reaches almost to the perineum. Later it recedes and if this recession process stops early the cul-de-sac of Douglas will be deeper than is normal. Thus congenital malformation of the sac may be one of the factors in the origin of the hernia. If there is also a developmental defect in the transversalis fascia it requires but little increased intra-abdominal pressure to drive the peritoneum as a wedge along the prolongation of the transversalis fascia. This is the incipient stage of prolapse.

The peritoneal covering of the anterior wall of the rectum is very adherent to the deeper coats and does not separate into a distinct peritoneal sac. The levator ani muscle and the very dense fascia on its lower surface also constitute a firm support to the

perineal body and prevent a downward progression of the hernia. The line of least resistance seems to be through the muscular wall of the rectum, thus permitting the hernial development. (Incomplete prolapse of rectum). The hernia now drives backward until it meets the resistance of the sacrum and coccyx when it is deflected downward through the rectal lumen, ultimately forcing the sphincters and appearing externally. (Complete prolapse of rectum).

In every case presented, the condition of the sigmoid, the levator muscle and the depth of the cul-de-sac must be considered. Zuckerkandl believes that an abnormally deep cul-de-sac acts as a pocket for the intestines which by their pneumatic pressure pry apart the musculature. In this manner whenever the protrusion is two inches or more in length we may expect that a fold of peritoneum, a coil of small intestine, an ovary or a part of the bladder wall is included.

Several factors may contribute to the development of the prolapse, and in the case at hand a combination of these may be found. Complete prolapse usually comes on slowly, through long continued action of the primary cause, but in either children or adults it may come on suddenly as a result of severe straining during heavy lifting or as a result of a crushing accident or fall.

It may arise from tumor or stricture high in the rectum, which causes persistent peristalsis or straining at stool. Ordinarily about three to six inches may appear, although the whole colon and even part of the small intestine has been reported to protrude. Tillman cites a prolapse as large as a child's head.

When protrusion has taken place suddenly it may be constricted by the sphincter muscle and its reduction may be difficult. The complete type never develops from the incomplete type, nor as a complication with hemorrhoids or other tumors arising from the anal canal because these are situated near the anal outlet and drag down the mucous membrane only to such an extent as is permitted by the stretching of the elastic connective tissue of the submucosa.

#### SYMPTOMS.

The symptoms of complete prolapse are much the same as those of the incomplete type. The complete prolapse begins within the rectum and protrudes through the anal orifice, thus leaving a sulcus between the prolapsing gut and the anal margin. The distinguishing feature of a complete prolapse of small extent from an incomplete one of the same size is that the external surface of the protruding tumor is not continuous with the anal skin margin. There is no



sulcus between the prolapse and the anal margin in the incomplete prolapse.

The protrusion is thick, firm and pyriform in shape, and when not more than three inches are present, the prolapse will extend straight out at right angle to the buttock with a slit-like orifice in the lower end. When more than this appears, traction upon the mesorectum draws the tumor backward toward the coccyx and the orifice will be on the posterior surface. In exaggerated cases where the mesorectum and mesosigmoid are both dragged upon, the prolapse may make two or three corkscrew circuits. Sometimes in females the traction is forward, because of vaginal attachments.

In old cases a hyperthrophy of the exposed tissue occurs. All of the coats of the bowel are edematous and swollen and often ulcerated. The mucous membrane is thick, dense and leathery in structure in the frequently prolapsed parts. The submucous areolar tissues are infiltrated with a hyaline substance, and the muscular layers are hypertrophied. The extruded part is therefore enlarged not only by edema and congestion, but also by the development of new structures. Therefore, the prolapse does not recede to its normal size when replaced and is often too large to be retained, and descends the next time the bowels move.

In old or extreme cases replacement is difficult and painful, although gradually the anus becomes patulous and the sphincter so paralyzed that each time the sufferer defecates or even moves about, the mass protrudes and makes his life a burden. The bowel is abnormally increased in size, and too large for its proper position within the pelvis, and although it may be reduced, it will not remain so because the tenesmus set up by its presence expels it promptly. In some instances the mucous membrane is eroded and granular and easily bleeds. In such cases the odor of the sloughing tissues may simulate malignant disease. A prolapse that has protruded for some time is often accompanied with an oozing hemorrhage, which requires astringents to control.

In children the procidentia occurs only at stool, but in aged persons with relaxed sphincters it may be down all the time. Constipation is the rule unless excoriation has occurred, when a teasing diarrhea may be present. In either instance bloody and mucous discharges are present, and later fecal incontinence comes on. Pain is complained of only when there is ulceration of the prolapse or when spasm of the sphincters occurs, which constricts the prolapsed bowel. Strangulation is present only in young and

robust persons, and is rare in infants or the aged. When it does occur it may be only temporary, but if it continues, ulceration and gangrene will follow which may terminate fatally if the peritoneum is involved. When the lower part of the rectum alone is involved in the gangrene, a spontaneous cure may take place, but by the separation of the protrusion and the resulting cicatrix a stricture is finally produced which leaves the patient in a more deplorable condition than before.

#### COMPLICATIONS.

Complications are prone to arise with the involvement of the peritoneal coat, for it is likely to carry down with it a loop of small intestine, an ovary or the bladder wall. When these organs are brought down, they are usually detected by touch and are generally found in the anterior part of the tumor. The intestine slips away from between the fingers with a gurgling sound, due to the contained gas, or sometimes percussion demonstrates it by resonance. In the early stage the loops of the bowel are contained only in the anterior part of the prolapse and cause a rounded, tense prominence of this portion. But if the protrusion is large the loops may wholly surround the prolapsed bowel, except at the mesenteric attachment. In practice, if the buttocks are raised, the hernia usually recedes with a gurgling sound, and the prolapse may then be easily reduced. Adhesion between the loop of the small bowel and the prolapsed rectum may occur and strangulation result, because the hernia cannot be reduced, or if the strangulation is not promptly relieved, death ensues from perforation of the bowel and peritonitis. If an ovary is included in the prolapse, pressure on it causes a faint, sickening feeling; if the bladder, this is shown by introducing a sound through the urethra. Each condition constitutes a true hernia of the prolapse and must be immediately replaced, if possible, because spontaneous rupture of the rectal wall or of the peritoneal cul-de-sac and evisceration of the intestines has occurred and, of course, adds a most serious complication. Usually there is no sulcus or depressed line visible at the peritoneal or bladder junction with the bowel, and so there is no way of determining by inspection the presence or absence of peritoneum or bladder in the prolapse.

#### DIAGNOSIS.

The differential diagnosis between the partial and the complete prolapse is often important. Prolapse of the mucous membrane alone is usually recent, the tumor is small, thin and soft to the touch, and the folds radiate from the orifice which is circular and



patulous. When the deeper coats are involved the case is usually of long standing, the tumor is large and conical in shape, and its walls are thick and firm. The opening into the bowel is slit-like, and usually points backward owing to the traction of the mesocolon, or points forward because of the vaginal attachments.

Hemorrhoids or neoplasms of the rectum that prolapse are differentiated by their irregular and lobulated shape and by finding other parts of the rectal circumference remaining in situ. Excoriation and hypertrophy resulting from the discharge may simulate epithelioma and may be differentiated only by a microscopical examination.

30 NORTH MICHIGAN AVENUE.

## PLASTIC AND COSMETIC SURGERY OF THE HEAD AND NECK.

H. LYONS HUNT, MD., L.R.C.S., (Edin.)  
and

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### KELOID.

These are partially innocent formations which, depending rather on the point of view than on actuality, vary from exaggerated scar formations, to new growths of odd sizes and characteristics, bordering almost on the malignant. Hypertrophied cicatrix is not keloid, morphologically or pathologically, nor does it yield to the same therapeutic measures. Pseudo-keloid or exaggerated scar differs from a true keloid in that the latter has marked irregularity in the disposition of the proliferating collagen bundles. Histologically, in the scar or pseudo-keloid, there exists a perifollicular infiltrate surrounding the neck of the follicle. A plasmoma of the adjacent cutis is present, and finally a fibroma originates from the deep layers of the cutis. A cross section of keloid shows a dense, fibrous growth in which the bloodvessels and cells are widely separated. They possess a local malignancy so pronounced as to make it certain that there will be recurrence when apparently successfully removed. Morrison believes that they are associated with sepsis and tubercle of the chronic type; that on the skin, burn scars, which take a long time to heal, and scars resulting from tubercle, are their favorite sites. When one is subject to scar keloids, similar growths are often found in other parts of the body. In the mouth, they are called epulis, in the stomach, linitis plastica, in the small intestines, fibrosis, in the cecum, hyperplastic tuberculosis, though no tubercle bacilli are present, in the pelvic colon, peri-diverticulitis.

The condition commences in the corium and may

start spontaneously in the skin or in a scar. The yellow and darker races are more prone to the disease than are Caucasians. Other than these racial characteristics to account for this condition, few theories have been advanced for the cause. From a series of experiments we believe that an internal secretion (an hepatic endocrine) may be accountable for the condition and basing treatment on this theory, a new therapy is laid before the profession for consideration.

The fact that there are many cases, chiefly in the colored races which show extensive multiple keloid and at the same time flat scars from trauma, would indicate that the etiological factor is not at all times present in the same individual. "Thick-skinned" individuals seem to be more susceptible than people of thin skin.

Methods of treatment:—(1) Excision. (2) X-rays. (3) Electrolysis. (4) Thiosinamin. (5) Injection of formalin. (6) Finsen ray. (7) Injection of creosote oil. (8) Exposure to radium. (9) Massage and pressure. (10) Injection of bile.

Most of the above methods of treatment have been used, many empirically, with varying degrees of success. One is tempted to try excision in all cases of keloid. From experience, nothing does more harm, the keloid constantly returning, if anything, in a more malignant manner. Excision with transplantation of the Ollier-Tiersch graft have produced little of good and much of poor result, in our hands. Much has been written by radiologists of the successful treatment of keloid by x-rays. Winfield reports several cases of successful treatment of keloid by this method, as do several other radiologists. Gaucher has brought forward a treatment of keloids by Finsen rays, stating that "The use of radio-therapy as a cure for keloids has the disadvantage of sometimes leaving the patient with radiodermatitis or ulcers of which the cure is long and difficult. For this reason, one has tried to achieve results with less dangerous chemical rays." He quotes, in speaking of the Finsen ray treatment, three successes. Simpson states that pure keloids, especially those of young children, and keloids of recent formation, can often be resolved with selective doses of radium rays, i. e., within the amount of raying that causes little or no inflammatory reaction. The following is quoted from Simpson's description of his treatment: "Keloids mixed with scar tissue are more resistant to radium, but can generally be made to disappear by using doses that cause more or less destructive action. The exact doses necessary in individual cases it is difficult to state, but after some experience with different applicators is obtained,



an approximate estimate of the amount of raying necessary can often be given, especially if the clinical type of keloid is clear.

"Pain is usually relieved at the same time with the resolution of the tumor. The apparatus and technique employed vary somewhat with the type of lesion. With keloids of considerable size, the varnish applicator is by far the best to use. For linear keloids, the radium tubes are convenient although the varnish applicators can be used by screening off the healthy tissue on each side of the keloid.

"In practice the theoretic use of purely selective doses must often give way to the more rapid method of destructive doses. The general principle of using a sufficient dose to produce a slight but not excessive reaction is the one I usually follow. Repeated and strong reactions are usually unnecessary, and are liable to be followed by telangiectases".

Quite different is the experience of Albert Weil, who states, "Having observed that very strong screened rays seem destructive to neoformation, I have used systematically in all cases screens of 2 to 3 mm. aluminum, and at each radiation I applied to the keloid one dose of 7 to 8 H, well limited by a plaque of lead to protect the healthy skin. Thus I cured a great number of children of keloid following tubercular adenopathy or accidental wounds. I use only the very strong rays produced by a Coolidge tube regulated to emit a spark equivalent to 21 to 24 cm. when it carries 1 ma8, or 2 milliamperes, screened by 5 mm. of aluminum".

Thiosinamin in 10% solution, by injection, has been recommended by Tousey, Crocker, and Purnet, as useful, while Leloir and Vidal have recommended linear and punctuate scarifications, followed by the application of an antiseptic dressing of wet or dry boric acid. Both of these treatments have been found to produce but little of success in the hands of others who have tried them. Lesieur, in consideration of the predisposition of the scrofulous cicatrization, treated one hundred cases by the injection of oil of creosote, claiming good results.

It will be seen from all of the above treatments, that their application has been founded on empiricism, rather than on scientific principles. In consideration of the fact that the favorite site of keloid is in a scar, sometimes only microscopic in character, and also in consideration of the fact that these troublesome growths appear to form more readily in the dark, thick skinned, scrofulous subject, we have approached the treatment of keloid from a rather different basis.

In an ordinary healthy individual, a wound is followed by a hemorrhage. The white cells appear to break up and set free prothrombin, which unites with the calcium chloride of the plasma to form thrombin or fibrin ferment, which acts on the fibrinogen of the plasma to form fibrin which, we are told by our physiologists, holds the edges of the wound together. The leucocytes seem to have a secondary duty, that of absorbing any blood clot or foreign matter present. Fibroblasts now supplant the leucocytes. These fibroblasts form permanent scar tissue.

In people of scrofulous diathesis when attacked by tubercle bacilli, we find a somewhat similar process, i. e., the bacillus gives off its irritating toxin, which acts on the connective tissue cells of the part, causing them to enlarge. These large connective tissue cells are known as epithelioid cells. They are similar to fibroblasts. Their apparent duty is to wall off further invasion by the attacking microorganism. One might well consider them keloid in character. A rather similar process takes place around any foreign matter introduced into the body. This process is almost entirely lacking in one suffering from jaundice. Fibrin ferment is deficient. Epithelioid cells and fibroblasts have difficulty of birth. In the healthy individual this process is moderately present. In the scrofulous it is excessive. Basing theory on these known facts we have recently been in the habit of removing skin sutures twenty-four hours after operation to avoid scar formation. Such a procedure does not permit of sufficient time for fibroblasts to form around the subcuticular suture material used, and the results have been an absence of the formation of scar tissue.

To prevent the excessive formation or tendency to keloid formation, infiltration of wounds and keloids by sheep bile is being tried in our clinics. At our request, Burrough & Wellcome are preparing in their London laboratories a preparation of turtle bile. This preparation is being put up in ampoule form to be used not only in the prevention of scars following operations, but also for infiltrating keloid formations, and we hope to report even better results with this ingredient than with sheep bile.

*(To be continued)*

One cannot be a gynecologist and do his patients justice without constantly weighing the finer points in urology and having the facilities at hand to decide whether the patient's chief complaints arise in the genital or in the urinary tract.—GUY L. HUNNER in *The Urologic and Cutaneous Review*.



FULL TERM ABDOMINAL PREGNANCY—  
REPORT OF CASE.

T. L. DEAVOR, M.D.,

SYRACUSE, N. Y.

Mrs. L. B., a patient in the service of Dr. Leroy T. Geer, was brought to the People's Hospital in January, 1916, with all the symptoms of tubal abortion. The family history was clear, and the patient, though fragile, had not previously passed through any serious illness. This was her first pregnancy, and menstruation had always been quite regular and free from pain. She had never undergone any surgical operation, and presented no congenital deviation of any kind. The heart action, though accelerated to 140, was free from adventitious sounds. Systolic pressure 120; diastolic, 80; pulse pressure, 40. Blood examination showed marked reduction in red cells, and an ascending leucocytosis, with a hemoglobin index of 60. The lungs were normal; tonsils slightly enlarged and cryptic; teeth somewhat deteriorated. The urine showed a trace of albumen, with an ammonia coefficient of 5. Wassermann reaction, negative.

The patient entered the hospital in a state of shock, due to internal hemorrhage, as shown by the rapid pulse, air hunger, restlessness, subnormal temperature and great pallor. Pregnancy had originated in the left Fallopian tube, and pain was increasingly severe in the left iliac region, where dulness, tenderness and point tenderness could be made out. There was no discharge from the uterus, either hemorrhagic or decidual. Vaginal examination was deferred from fear of producing further hemorrhage. The diagnosis was made upon the history of the case, sudden onset, absence of marked rigidity, especially in the upper abdomen, the clinical picture of internal hemorrhage and the fact that we were dealing with a serious lesion, confined to the left side of the female pelvis. On the same ground, appendicitis and perforating ulcer of the gastro-intestinal tract were easily ruled out. Certain other points in differential diagnosis are omitted here, since the conclusion reached at that time was subsequently verified. Menstruation two months previous was scant, and absent thereafter, making the period of gestation about seven weeks.

After consultation with Dr. Geer, considering the patient's condition in every way, it was very plain that immediate abdominal section was out of the question, even under local anesthesia. Transfusion could not be done for want of a suitable donor. Hemoplastin was not then available. Expectant treatment was therefore advised, the family concurring with much satisfaction. At the end of twenty-four hours, under absolute rest, ice to the lower abdomen and small doses of morphine to allay irritability and sustain the heart, there was evidence that active hemorrhage had ceased. From that time on the patient slowly improved, so that consent to operate was refused.

After eight to ten weeks had elapsed, the patient

had quite recovered from all urgent symptoms, and the anemia was beginning to disappear. Very soon, however, a symmetrical mass appeared in the pelvis, without pain or tenderness. The first thought was that we were dealing with an associated normal pregnancy, that in the tube having perished at the time of rupture. This belief was strengthened by the fact that at no time had there been either external hemorrhage or expulsion of decidua. As the abdomen gradually enlarged, the patient got up and went about, with few unfavorable signs of any kind. Before leaving the hospital, a bimanual examination showed that the small unimpregnated uterus was doubtless being crowded to the right by an advancing extrauterine pregnancy. Again operative treatment was refused. The case was carefully directed by Dr. Geer, and all arrangements made for probable future delivery by laparotomy. Palpation of the abdomen at various times gave information similar to that derived from normal pregnancy, except that the mass was high and always occupied a transverse position. Fetal heart sounds could be easily determined. Without any knowledge of the history here, the real condition could not have been suspected. As nearly as possible, the period of gestation was figured, and a date set for the operation, hoping to anticipate the onset of labor, and thereby save the child. Much to our regret, this plan was frustrated. The patient, feeling perfectly well, had gone into the country to visit relatives, and therefore came to the hospital several days late.

On August 31st, the abdomen was opened and the patient delivered of a perfect male child, weighing seven and one-fourth pounds, which, however, had been dead about twenty-four hours. The amniotic sac was complete, but widely adherent to the omentum and intestines. Parts of it could not be removed. The uterus was enlarged to three times the normal, though not materially softened. The placenta was fully twice the usual size and thickness, and was firmly attached to the sigmoid, the side of the uterus and the anterior abdominal wall. Its exact relation to the left Fallopian tube could not be disclosed. Every attempt at extraction was followed by such profuse hemorrhage, that it was impossible to go further. A gauze tampon was inserted, after the order of a Mikulicz drain, and the abdomen closed well around it. The patient was put to bed in a state of shock from loss of blood, but rallied well, and made a good recovery. She is well today, six years later. Ventral hernia did not follow drainage.

## COMMENTS.

If a ruptured tubal pregnancy is not operated upon at once—to wait, I believe, is the exception—absolute rest is essential, and must be carried out literally to do any good. Both patient and nurse should fully understand the course to be followed. Rest of body and mind is needful. All visitors, whether relatives or friends, are to be kept away. The nurse must be tactful; born to inspire hope and confidence. The patient should not be allowed to attempt the



smallest move of hand or foot, or even slightly change her position in bed, for the first twenty-four hours. Mental anxiety, fear and apprehension will often accelerate the pulse rate, disturb clot formation and cause a fresh hemorrhage. The greater the anemia, the less the tendency to coagulation. The condition is rendered still more precarious by a swiftly moving blood stream in the presence of open vessels.

Why does gestation terminate at a certain time, and what takes place to initiate the onset of labor? Some believe that labor is the last link in a chain of circumstances. Others, that it is a natural process, and therefore must be so. But these are empty statements; replies without explanations. Williams gives several reasons for the onset of labor. Among them are changes in the decidua, the effect of placental blood upon the nerve centers and increasing irritability of the uterine muscle to intermittent contractions. All these are very plausible theories. And yet, surrounding the whole matter is a good deal of mystery which has never been fully cleared up. One thing is certain. The offspring will die, soon after maturity, if not separated from its mother. In abdominal pregnancy, spontaneous delivery cannot occur: hence the need of celiotomy. Early operation endangers the mother's life; late operation, that of the child.

Of more importance in this connection is the fact that labor, in all types of pregnancy, is an end-result, and necessarily makes a profound alteration in the child's environment. We are accustomed to think of labor as a period of great suffering. But may not labor, in its true sense, be a hidden process with pain and uterine contraction as outward manifestations. If pregnancy and labor are normal in every way, the offspring is expelled alive, with a chance to survive the vicissitudes of extrauterine life. Not so in abdominal pregnancy. Nevertheless, there comes a moment when gestation ceases and labor is ushered in, just as truly, perhaps, as with the uterine form; but, unassisted, disaster awaits its termination. The mother may be entirely unconscious of the change that is taking place. There is neither pain nor expulsive effort. There is a mere syndrome, a quiet shifting of scenes. And the outcome is a silent tragedy; for the child is lost in sight of home.

It is imperative, then, in all cases of abdominal pregnancy going to full term, that we observe the patient closely during the latter days of gestation, and operate promptly, though not too soon, while the fetal heart sounds are yet distinct, and the movements of the child quick and well defined.

## LIGATION OF THE COMMON FEMORAL ARTERY; WITH REPORT OF A SUCCESSFUL CASE.

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Anatomically the femoral artery begins at the lower border of Poupart's ligament and terminates at the adductor foramen where it enters the popliteal space. For convenience of study the artery may be divided into three sections: (a) a superior segment in Scarpa's triangle, (b) a middle segment covered by the sartorius muscle, and (c) an inferior segment in Hunter's canal. Its general direction may be indicated by a line drawn from midway between the symphysis pubis and the anterior superior spinous process of the ilium to the posterior surface of the intercondylar process of the femur.

In the superior segment are the following branches: the superior epigastric, superior circumflex iliac, and the external pudic. This segment is covered by the skin, subcutaneous fascia and fat, the superior lymph vessels and glands, and the fascia lata. At the apex of Scarpa's triangle the artery lies just below and to the inside of the sartorius muscle. Near the base of the triangle the femoral vein is to the inside of the artery but is underneath it at the apex. No large nerves accompany this segment of the artery. The femoral nerve passes under Poupart's ligament in the sheath of the ilio-psoas muscle.

The middle segment is the longest and is covered by the sartorius muscle throughout. The long saphenous nerve accompanies it, and although not in its sheath, must be separated from the artery in ligation. The femoral vein lies under and to the outside of the artery.

The inferior segment is entirely in Hunter's canal. The femoral vein is behind and to the outside, but in the same sheath. The long saphenous nerve accompanies it and lies above and toward the inside, but not in the sheath.

Stimson states that during the half-century (prior to 1700) surgeons learned that it was unnecessary to amputate the leg of an individual because the femoral artery had been wounded; that ligation of the injured artery had been successfully practiced as early as 1646, and again in 1688, but it was not formally proposed as a substitute for amputation until nearly a century later. Surgeons had formerly laid too much stress upon the necessity of large collateral branches being present, "since it had been shown that the trunk of the femoral artery might be ligated in any part of the thigh without producing mortification of the limb". Even as late as 1710, however, surgeons



attempted the cure only of traumatic aneurisms of the brachial and temporal arteries following venesection (i. e., by application of the ligature); against popliteal and femoral aneurisms they knew no resource except amputation of the limb; they had yet to learn that the femoral artery could be ligated without causing gangrene of the leg.

Search of available literature discloses no statistical information concerning any phase of this subject. Bryant (*Operative Surgery*, 2nd ed.) says the results of ligation of the femoral artery have been given as follows: in thirty-one cases in which the common femoral was ligated the mortality was forty per cent.; the superficial femoral has been ligated two hundred and four times with a mortality of fifty cases. The artery has been ligated: (a) just below Poupart's ligament, (b) at the apex of Scarpa's triangle, and (c) in Hunter's canal. During the operation avoidance of the veins is important; in Hunter's canal the long saphenous nerve must also be remembered.

#### CASE REPORT.\*

R. H., male, aged twenty years, was admitted to the Louisville City Hospital as an emergency case during the night of April 1, 1920, having received a gunshot wound in the midline of the left thigh about one-half inch below Poupart's ligament.

There was a wound half an inch in diameter in the situation described from which blood was steadily flowing. The left leg looked blanched in comparison with the right, and no pulsation could be detected in the posterior tibial, the anterior tibial, or the popliteal artery. There was considerable shock.

The patient was taken immediately to the operating room and after exposing the external iliac artery above Poupart's ligament temporary occlusion of the vessel was accomplished by rubber covered hemostats. The common femoral artery was then dissected free, and was found to have been practically severed by the bullet. An attempt was made to perform anastomosis of the femoral, but as further rupture occurred immediately on releasing the external iliac, it was deemed wise to resort to ligation above and below the perforation and await the outcome, which was done and the ordinary dressing applied.

The leg was wrapped in cotton and treated on the expectant plan with the result that the patient lost only the plantar surface of three toes from dry gangrene. During convalescence ischemic myositis of the calf muscles developed with a resulting toe-drop which was relieved by tenotomy of the tendo achillis.

The patient was dismissed from the hospital June 18, 1920. He has since remained in good physical condition and has gained several pounds in weight. Collateral circulation seemed adequate, the lower ex-

tremity was properly nourished, and the man was able to walk comfortably. Under the circumstances I believe the result is all that could possibly have been expected.

The following table is appended merely to show the development of collateral circulation after ligation of the common femoral artery:

<i>Above With:</i>	<i>Below With:</i>
Gluteal from internal iliac;	External circumflex from
Deep circumflex from external iliac;	profunda;
Obturator and sciatic from internal iliac;	Internal circumflex from profunda;
Commes nervi ischiadici.	Arteries of ham.

Current surgical literature contains few references to ligation of the common femoral artery for traumatic injuries, scrutiny of indices at my disposal covering the last five years revealing only one or two such examples recorded in this country. Certainly additional cases must have been observed during the period mentioned, but for some reason they have not been reported. In this connection the pertinent observation seems strangely applicable that certain surgeons are prone to prematurely publish their apparently successful results, whereas their failures are seldom recorded.

#### REMOVAL OF CANCER OF THE TONSIL.

An incision about  $2\frac{1}{2}$  to 3 inches long is made at the anterior border of the sterno-mastoid muscle. The glands overlying the jugular are then dissected out. The facial vein is ligated in two places and then cut between the two ligatures. The external carotid artery is then tied off with a heavy ligature. The dissection is continued on up in the neck until the posterior belly of the digastric muscle comes into view. The muscle is then pushed aside, as are also the stylohyoid and the stylo-glossus, when the superior pharyngeal constrictor comes into view. The field of operation is then changed to the throat. Through the mouth the tonsil and infiltrated areas are thoroughly dissected out. An incision is then made through the superior constrictor in the neck and a strong light is then thrown into the wound through the opening in the mouth and also through the opening in the neck, enabling us to thoroughly remove any portion of infiltrated tissue that may be seen. This is especially looked for at the base of the tonsils, where it connects with the tongue. In the later operations we have then resected 2 or 3 inches of the sterno-mastoid muscle and the tissues about it for the purpose of preventing recurrence in the neck. The wound in the neck is then partly closed by retaining sutures after packing with gauze and the wounds are allowed to heal by granulation.—JOHN MCCOY in *The Laryngoscope*.

\*This case was briefly mentioned and the patient exhibited before a meeting of the Jefferson County (Kentucky) Medical Society in December, 1920. The case record with discussion will eventually appear in the Transaction of that organization.



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, JULY, 1921.

## THE MELTZER-LYON TEST OF BILE-TRACT DISEASE.

Several years ago the late Samuel Meltzer demonstrated that magnesium solutions applied to exposed nerve trunks cause complete blocking peripheral to the point of application, and he introduced the intraspinal injection of magnesium sulphate solution for the relief of tetanus spasms. Four years ago he published his observation that magnesium sulphate solution, in the duodenum, relaxes the duodenal wall and Oddie's bile duct sphincter, and he invoked the "law of contrary innervation" to explain a flow of bile from the gall-bladder into the bowel coincident with the relaxation of this sphincter. He suggested that the introduction of a concentrated solution of magnesium sulphate through a duodenal tube might relieve certain types of jaundice.

B. B. V. Lyon, of Philadelphia, saw in Meltzer's suggestion the opportunity for investigations that might prove of diagnostic importance and physiologic interest, and during the past three and a half years he developed the procedure of duodenal intubation with magnesium sulphate solution in over 300 cases. His observations have been published in the *Journal of the A. M. A.*, September 27, 1919, and in various subsequent articles.

Briefly stated, Lyon found that, after introducing magnesium solution into the duodenum there could

be aspirated or siphoned therefrom in a definite order of succession bile of differing color and consistency. At first there appears the bile from the common duct ("A" bile), then a darker, thicker ("B") bile, which Lyon asserts is from the gall-bladder, then a lighter ("C") bile from the hepatic ducts and finally the light yellow ("D") bile from the liver itself. Lyon finds that from the character of the bile, then, he can determine and locate an obstruction (e., g. in the cystic duct, which would prevent the flow of any B bile) and by an examination of the B bile, bacteriologically, cytologically and chemically, can determine the presence of gall-bladder disease. His deductions, as corroborated at operation, are impressive, indeed.

Lyon has found in this procedure, moreover, not merely a helpful adjuvant in diagnosis, but also, as Meltzer had suggested, a valuable measure in the treatment of biliary affections by "internal drainage", as a substitute for surgery in some cases and as a post-operative method of securing or maintaining cure in others. Indeed, Lyon's recent articles indicate enthusiasm concerning the therapeutic value of internal biliary drainage by duodenal intubation with magnesium sulphate, and his case reports would appear to justify that enthusiasm. One case, among others recorded in his article in the *Rhode Island Medical Journal*, May, 1921, is a striking one as illustrating not merely the value of the method in treatment, but also the possibility of accuracy in his interpretations of the duodenal bile. This case was that of a woman who had a persistent fistula following a cholecystostomy for empyema of the gall-bladder without stones, eight years previously. There were frequent attacks of severe pain, which appeared to be associated with accumulation of whitish mucus in the gall-bladder. Lyon obtained from the gall-bladder, through the fistula, and by drainage into the duodenum, bile of the same physical and cytological characters, and in both specimens were recovered *streptococcus hemolyticus* and *bacillus coli*. After a course of treatment by internal drainage and autogenous vaccines the infection and pain ceased and the fistula definitively closed. Lyon's cases also, it is of interest to note, would appear to support the doctrine of focal infections and to the value of vaccines in their treatment.

So fascinating is the method of study that Meltzer and Lyon thus opened up, so important is it diagnostically, therapeutically and physiologically, that it is of great interest to see what other observers have done with it. Thus far, publications, other than Lyon's, have been few. In the *Journal of the A. M. A.*, June 4, 1921, Crohn, with the collaboration of



Reiss and Radin, report a careful study from the medical department and the laboratory of Mount Sinai Hospital, New York. They corroborate many of Lyon's observations, but have been unable to confirm his determinations of "B bile" as secured by the duodenal tube. They find, from microscopic sections taken from man and dog, and from observations of the opened duodenum of anesthetized dogs, that the circular fibers described by Oddie are not anatomically a sphincter but, nevertheless, that a sphincter action at the papilla of Vater is plainly demonstrable. Injecting methylene blue solution into the gall-bladder of dogs they were able to recover blue-stained bile from the then opened duodenum only after squeezing the gall-bladder, or by causing general abdominal contractions by faradization of the right vagus.

No amount of magnesium sulphate caused any expulsion of the gall-bladder contents. A slight flow of light golden yellow bile, apparently liver bile, followed, but no contractions of the gall-bladder, and no blue discolored bile appeared. This experiment was repeated on eight dogs with the same negative result.

Crohn made Lyon tests in 70 cases of gall-bladder, bile duct or related diseases, 20 of which he was able to follow to the operating table.

After the magnesium sulphate lavage the flow of bile was truly more profuse and abundant, usually of a darker shade, varying from dark yellow or orange to a dark brown or deep greenish brown. After from twenty to forty minutes the shades of bile became again lighter, and within from three fourths of an hour to one hour returned to the original hue. This change took place in a large percentage of cases (65 per cent.) and was accompanied by a pathologic condition (stones or chronic cholecystitis) in 62 per cent. of these cases. In the remaining 38 per cent. of the cases, a definite change to darker and cloudier bile occurred after the lavage with magnesium sulphate, yet no pathologic condition was found at operation.

In seven cases no change of color followed the lavage, which according to Lyon, would indicate obstruction of the cystic duct. In three of these, stones were found in the cystic duct. In the other four cases no cause was found at operation to explain the phenomenon.

Whence comes this darker, heavier bile ("B" bile) which follows the lavage with magnesium sulphate? Is it really gall-bladder bile as contradistinguished from duct or liver bile? It is of some significance that 62 per cent. of the cases with change of color in the duodenal content after the saline lavage were associated with definite pathologic changes in the gall-bladder or with stones, or both. One may not necessarily infer from this that dark bile is significant of a pathologic condition of the gall-bladder, for the remaining 38 per cent. of cases showed dark colored bile and yet the gall-bladder and ducts were pronounced normal at the operating table. It would, in addition, be difficult to reconcile with this conclusion a case in our series. This was one in which the gall-bladder had been removed at a previous date; in this instance, one of post-operative stricture of the common bile duct, the bile before the lavage was light lemon yellow, while after the saline lavage it was a dark brown, mucoid and grumose liquid. As there was no gall-bladder present in this case, the change of color was evidently due to the flow of duct bile.

\*\*\*\* The bile aspirated from the gall-bladder at operation was nearly always darker, a deep dark brown shade, and more mucoid in consistency than the "B" bile in the duodenum. Microscopically, no similarity could be seen in the sediments of the two compared fluids. Often, on the basis of finding detritus and numerous pus cells in the duodenal sediment of the secondary bile, we would predict chronic cholecystitis, and often correctly so. But on sedimenting the fluid removed by aspiration of the gall-bladder at the operation, we could not find the same pus cells and characteristic sediment found in the "B" bile specimen. This should not be a surprising statement, for old chronic cholecystitis with or without stones and with adhesions is usually, at the operating table, a sterile process, at least as regards the finding of frank pus or visible bacteria within the gall-bladder lumen. We have received many such specimens and failed to find a purulent sediment or bacteria. Then why should we expect to find them in the "B" bile, even if this "B" bile is gall-bladder fluid? If frank suppuration or an acute inflammatory process is present in this organ, the first result is a swelling and occlusion of the cystic duct.

The last-mentioned condition is familiar enough to the surgeon; but occlusion of the cystic duct is not found at operation with all grades of gall-bladder infection. That patency of the duct may be restored after the acute infection subsides is illustrated in Lyon's case above quoted.

While Crohn and his co-workers do not accept all of Lyon's deductions, their observations corroborate his in a goodly percentage of cases. The discrepancies remain to be explained. Crohn has raised a rational doubt concerning the safety of postulating gall-bladder conditions from examinations of Lyon's "B bile", and it must be determined by others whether the method is as reliable as Lyon believes it is. Perhaps, like so many other tests in medicine, there are variations and exceptions that have to be taken into account. Even so precise a biochemical reaction as Wassermann's may be absent in syphilis and present in other conditions, but its value is very great indeed. Ehrlich first thought salvarsan would cure syphilis in a single dose; that it does not do so has not made us abandon it as a specific.

## Book Reviews

### Orthopedic Surgery of Injuries. By Various Authors.

Edited by SIR ROBERT JONES, K.B.E., C.B., F.R.C.S., Director of Orthopedics, St. Thomas's Hospital; Surgeon, Royal National Orthopedic Hospital; Consulting Orthopedic Surgeon, Royal Infirmary, Liverpool; Honorary Adviser to the Ministry of Pensions (Orthopedic Surgery). Royal octavo; *Volume I*, 540 pages, 206 illustrations; *Volume II*, 692 pages, 267 illustrations. London: HENRY FROWDE, Oxford University Press; HODDER & STOUGHTON, 1921.

We recently reviewed a two-volume French work on "Chirurgie Réparatrice et Orthopédique" edited by Jeanbrau, Nové-Josserand, Ombrédonne and Desfosses. "Orthopedic Surgery of Injuries" is a very similar work, also in two volumes, by British (and three American) authors. It is edited by the master, Sir Robert Jones, who has written the sections on Mal-union of the Femur, Ankylosis and Stiff Joints, and Flail Joints.



Volume I is devoted to the orthopedic surgery of injuries to the bones and joints. In addition to an interesting historical sketch of Hugh Thomas, by Arthur Keith and the three articles by Jones, it contains the following: The Prevention of Deformities, by Sir Henry Gray; Principles of Orthopedic Surgery as they Apply to the Military Need, by Joel Goldthwait (Boston); Simple Fractures of the Extremities, by W. H. Trethowan; Splinting of War Fractures, by H. G. Carlisle; Ununited Fractures, by E. W. Hey Groves; Chronic Osteomyelitis, by R. C. Elmslie; Disabilities of the Shoulder and the Elbow by Naughton Dunn and S. W. Daw; Orthopedic Surgery of the Hand and Wrist, by Walter I. Baldwin (San Francisco); Disturbances of the Lumbar Spine and Pelvis, by F. C. Kidner (Detroit); Ankle and Foot, by David McCrae Aitken; Amputations, by Elmslie; Organization of Centers for the Limbless, by Sir John Lynn-Thomas.

Volume II contains eight articles, by well-known authors, on the anatomy of the peripheral nerves, the diagnosis, prognosis, operative and post-operative treatment, and end-results of injuries to the peripheral nerves; an article on Tendon Transplantations and Tendon Fixation in Irreparable Nerve Injuries by T. P. McMurray; Injuries of the Head and of the Spine, by E. Farquhar Buzzard and Percy Sargent; Functional and Reflex Disabilities by J. le Fleming Burrow and W. Cuthbert Morton; Splints and Plaster, by Aitken; Plain Metal Splints, by R. Layne Joynet; four articles on Electricity, Massage, Ling System of Exercises, and Hydrotherapy, respectively; and concluding articles on X-Ray Work, Organization of Curative Workshops and Organization of a Military Orthopedic Hospital.

It will be seen that these many special articles, authoritative in origin, cover well the field of orthopedic surgery of injuries, based upon experiences in war casualties but, also, translated into the adaptation of those experiences to injuries in civil life. They constitute a valuable treatise.

**Chirurgie de Guerre et d'Après-Guerre.** Par AUGUSTE BROCA, Professor à la Faculté de Médecine de Paris. Royal Octavo; 479 pages; 545 illustrations. Paris: MASSON ET CIE, 1921.

No surgeons in the war did more brilliant work, or made more important advances than the French. The medical literature—especially the books and the monographs, that have come out of France in recent years, numerous though they are, but commensurate with the achievements of French medical science, and are correspondingly important to the profession at large.

The work before us is a single volume, rather closely printed, by a single author—Professor Broca. It is divided, as its title indicates, into two parts. The first deals with the early treatment of war wounds and infections of the bloodvessels, the brain, the spinal cord, the thorax, the extremities. The second part is concerned with the treatment of late results—vicious unions, ankyloses, contractures, chronic osteomyelitis, amputation stumps, etc., with “*rééducation des mutilés*”—what we have come to call “reconstruction treatment”. The work is enriched by a large number of case records.

Professor Broca needs no introduction. In this volume he has given us not a compilation, nor a treatise, but a valuable record of personal experience.

**Treatise on Fractures in General, Industrial and Military Practice.** By JOHN B. ROBERTS, A.M., M.D., F.A.C.S., Emeritus Professor of Surgery in University of Pennsylvania Graduate School of Medicine; President of the American Surgical Association, etc., and JAMES A. KELLY, A.M., M.D., Associate Professor of Surgery in University of Pennsylvania Graduate School of Medicine; Attending Surgeon to St. Joseph's, St. Mary's, St. Timothy's and Misericordia Hospitals. *Second Edition.* Royal octavo; 755 pages; 1081 illustrations. Philadelphia and London: J. B. LIPPINCOTT COMPANY, 1921.

Since the appearance of the first edition of this work the chief developments in the treatment of fractures have been in the reversion to, and elaboration of, suspension-traction methods, and the subsidence—in favor of these and other

methods—of the popularity of fixation by internal steel plates. The latter procedure, described in the work, is, however, condemned by the authors as an operation of election.

In the second edition of this thorough and richly illustrated treatise, all the modernized methods of treatment, their indications and technics, are well described. The work is eminently practical, not merely in the directions for reduction and fixation, but also in the presentation of the mechanical factors underlying. Historical considerations and bibliographic references are excluded, although names are referred to freely. There is a good chapter on *fractures of the sesamoid bones* and chapters on *obstetric fractures* and *industrial and war fractures*, respectively.

Altogether, we find in this edition very much to praise and—barring some typographical errors—very little to criticise. Concerning fractures of the greater tuberosity of the humerus the authors advise, very properly, (page 326) that if the fragment is displayed upward and outward the arm should be placed in abduction and outward rotation. But they also say that if the fragment is not displaced the arm should be fixed to the chest. In this advise we cannot agree. Even if the fragment is not displaced it is better to employ abduction as a means of obviating the development of a “stiff and painful shoulder”.

**Clinical Surgery by Case Histories.** By ARTHUR F. HERTZLER, M.D., Ph.D., F.A.C.S., Professor of Surgery in the University of Kansas; Surgeon to the Halstead Hospital, Halstead, Kansas, and to St. Luke's and to St. Mary's Hospitals, Kansas City, Mo. *Volume I. Head, Neck, Thorax, and Extremities. Volume II. Diseases of the Abdominal and Genito-urinary Organs.* Royal Octavo; 1106 pages; 483 illustrations. St. Louis: C. V. MOSBY COMPANY, 1921.

These two volumes cover, indeed, a wide range of clinical surgery, interestingly presented by a great variety of case histories. Quite shorn of all irrelevant matter, they are very concise and, correspondingly, very readable. In many instances they are presented to show errors that could or actually did occur in diagnosis or therapy. “They represent, not achievement on parade, but rather the sober after-thought . . . they are intended to remind the reader of possible errors rather than to teach him how to avoid them . . .”.

The cases are arranged regionally and each is briefly recorded under the captions: history, examination, diagnosis, treatment, pathology, after-course, comment. Each case occupies but one or two pages of generous type, including illustrations. These, consisting chiefly of photographs, photomicrographs and drawings, are abundant, and well executed.

The reviewer has read through much of this work, with profit as well as with interest. It was a bit of a shock at this late day to find (page 372) the characteristic *x-ray* picture of a *subbursal* lime deposit in a case of subdeltoid bursitis interpreted as suggesting a *bony* change in the bursa. It is not surprising that Hertzler did not find the “bony change” because, although he “removed the wall” of the bursa he probably did not cut through its floor, beneath which, in or on the supraspinatus tendon, the deposit lay. Nevertheless the patient got well, which is also not surprising: in many cases subdeltoid bursitis can be cured without operation and often the lime deposit, which may or may not be present, undergoes absorption.

**Surgery of the Upper Abdomen.** By JOHN B. DEEVER, M.D., Sc.D., LL.D., F.R.C.S., Barton Professor of Surgery in the University of Pennsylvania; Surgeon-in-Chief to the Lankenau Hospital; and Surgeon to the University Hospital, and ASTLEY PASTON COOPER ASHURST, A.B., M.D., F.A.C.S., Associate in Surgery in the University Pennsylvania; Surgeon to the Episcopal Hospital, Philadelphia; Colonel, Medical Reserve Corps, U. S. Army. *Second Edition.* Royal octavo; 832 pages; 9 colored plates and 198 other illustrations. Philadelphia: P. BLAKISTON'S SON & Co., 1921.

The earlier edition of this work appeared in two volumes: the first, on the surgery of the stomach and duodenum, in 1909, and the second, on the surgery of the liver, gall-bladder, pancreas and spleen, four years later. Since then a great deal has been added to the surgery of the upper abdomen,



operative and diagnostic (e.g., Polya's method of gastrectomy, to cite but a single instance) and much that was then obsolescent is now obsolete.

This work therefore required, and has received, very thorough revision; indeed it appears to us to have been largely re-written. The result has repaid the great effort that must have been expended. It is now not merely an up-to-date and comprehensive exposition of the surgery of the upper abdomen, but also—more so than was the first edition—an interesting and attractive book.

Pictorially, the work has been much improved. Some of the old illustrations have been discarded, and about 100 new half-tone and other drawings have been introduced.

Although much other new matter has been introduced the book has about 130 fewer pages than those in the two-volume first edition. This has been accomplished by adopting a larger and more attractive type-page, by omitting some obsolete matter and the many pages of bibliography (the useful name index has been retained, however), and by condensing, or summarizing various statistical tables. Some of these have been replaced by the large statistical material which Deaver has developed in his own service at the Lankenau Hospital, Philadelphia.

**Diagnostik und Therapie der Knochen-und Gelenk-Tuberkulose.** Von Dr. med. EUGENE KISCH, Privatdozent der Chirurgie an der Friedrich-Wilhelms-Universität Berlin, Leitender Arzt der Heilanstalt für äubere Tuberkulose in Hohenlychen. Mit einem Vorwort von Prof. AUGUST BIER. Imp. octavo; 284 seiten; 6 Tafeln und 361 Abbildungen. Leipzig: F. C. W. VOGEL, 1921.

This work constitutes a piece of special pleading by a firm believer in the efficacy of the Bier treatment and heliotherapy in the treatment of joint tuberculosis, and is extremely interesting to the American reviewer, accustomed to an entirely different viewpoint. Fifty-three pages, or about one fifth of the reading matter, are devoted to heliotherapy, and to "stauung." The experimental evidence consists of clinical observation of cases in which these methods have been employed. The pathology is fragmentary, and is mostly drawn from former German writers. The references are scanty, and are mostly to writers of the same nationality.

In the chapter on spinal tuberculosis Kisch dismisses the Albee operation with a few words, and does not mention the Hibbs operation. On the other hand, the author, a good clinical observer, has illuminated his text with excellent photographs and tables, and beautiful colored plates, and has described well the rationale and technique of heliotherapy. In the convalescent stages of the disease he recommends the elaborate Hessing braces. The book is well gotten up, and the x-ray plates are exceptionally good.

**Tuberculosis of Children.** Its Diagnosis and Treatment.

By PROFESSOR DR. HANS MUCH, Director of the Department for the Science of Immunity and for the Research of Tuberculosis at the University of Hamburg, Germany. Translated by DR. MAX ROTHSCHILD, Medical Director of the California Sanatorium for the Treatment of Tuberculosis, San Francisco and Belmont, California. Small octavo; 156 pages. New York: THE MACMILLAN COMPANY, 1921.

Believing in the identity of the human and bovine types of tubercle bacilli, Much advocates more attention to the possibility of immunizing adults against tuberculosis by attacking the infection during childhood. He believes that whatever adult immunity exists results from the organic reactions to repeated exposures to the infective agent. No cure is possible therefore without an improvement of immunity.

The first part of the book discusses the author's interesting theories concerning the nature and development of immunity to tuberculosis and emphasizes the respective values of sera and cells and the existence of "partigens" as factors in supporting the action of tuberculin.

The artigens are of three class: F, containing the fat-acid-lipoids; N, consisting of the neutral fats; A, an insoluble residue probably formed of nucleoproteids. Much believes that the tubercle bacilli attack with four forces

against which specific antibodies are formed, wherefore the partigen antigens are all required for producing immunity and thus cure.

The second part is devoted to an essay on tuberculosis of children, with a major consideration of glandular infections, the treatment of which Much regards as the starting point for controlling the disease.

If the theories propounded are corroborated and the author's results are duplicated there will be an advance in the management of tuberculosis. Regardless of the future status of the theory and mode of treatment he has presented a stimulating and suggestive volume that merits the consideration of all interested in tuberculosis.

**Progressive Medicine.** A Quarterly Digest. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics, Materia Medica and Diagnosis in the Jefferson Medical College, Philadelphia; Physician to the Jefferson Medical College Hospital, etc. Assisted by LEIGHTON F. APPLEMAN, M.D., Instructor in Therapeutics, Jefferson Medical College, Philadelphia; Ophthalmologist to the Frederick Douglass Memorial Hospital and to the Burd School, etc. Volume I, 1921. Octavo; 374 pages; illustrated. Philadelphia and New York: LEA & FEBIGER.

The contents of this volume repay careful reading because of the wealth of timely compilation with appropriate comments by the chapter editors. Especially valuable in Dr. Charles H. Frazier's section on Surgery of the Head, Neck, and Breast are the portions devoted to cranial traumatism, to the treatment of pituitary growths and to surgery of the thyroid and jaws.

Dr. J. Ruhrah presents particularly interesting phases of encephalitis, the etiology of chicken pox, and rat-bite fever in the chapter on Infectious Diseases, including acute rheumatism, croupous pneumonia and influenza. In the discussion on Diseases of Children, Stafford McLean has placed stress upon problems of nutrition and the nature and manifestations of malnutrition.

Other sections include Surgery of the Thorax by George P. Muller and Rhinology, Laryngology and Otology by George M. Coates.

**The Oxford Medicine.** By Various Authors. Edited by HENRY A. CHRISTIAN, A.M., M.D., Hersey Professor of the Theory and Practice of Physic, Harvard University; Physician-in-Chief to the Peter Bent Brigham Hospital, Boston, Mass., and SIR JAMES MACKENZIE, M.D., F.R.C.P., LL.D., F.R.S., Consulting Physician to the London Hospital and Director of the Clinical Institute, St. Andrews, Scotland. In Six Volumes. Volume III: *Diseases of the Digestive System, Kidneys and Ductless Glands.* Imperial octavo; 828 pages; illustrated. London and New York: OXFORD UNIVERSITY PRESS, 1921.

The general aspect and tone of this volume, as compared with Volume II, is distinctly better. The general average of the articles is unusually high, the space allotments are more reasonable and the choice of topics reveals a better consideration of the sense of values. The first article on *Diseases of the Esophagus*, by Channing Frothingham, is poor. The exposition is elementary, the text is hackneyed and there are no illustrations. Nor can we understand the sense of appending a so-called "bibliography," in which no clue to the topics of the articles is given either in the reference or in the text. The articles on *Diseases of the Stomach*, by Rehfuss, and on *Ulcer of the Stomach and Duodenum*, by Lippy, are well written. That on *Diseases of the Intestine* by Stockton, is satisfactory. The three succeeding chapters on *Diseases of the Liver and Diseases of the Gall-Bladder and Ducts*, by Sir Humphrey Rolleston, render distinction to this volume. If this volume contained nothing else, these articles would make it worth possessing. They are written with all the mastery of the subject that have made Rolleston's text-book on Diseases of the Liver one of the medical classics. The articles on *Diseases of the Pancreas* by Joseph A. Pratt, and *Diseases of the Peritoneum*, by M. C. Pincoffs and Thos. B. Boggs, deserve exceptional praise. Christian, in his chapters on *Nephritis* probably gives as good a presentation as this much vexed subject will permit. Many



will differ with him in some of his contentions. We believe, for instance, that his classification of chronic nephritides into those with edema and those without edema is a step in a backward direction: we still believe that classification based on pathology is entirely feasible. Nevertheless, Christian gives a very fair and judicial presentation and never fails to emphasize the defects in the chain of evidence. If anything, Christian seems too timorous in setting down his own views. Much of the text in these articles is devoted to case reports. We question the value of teaching by the "case method" in a monographic system of medicine of this character. It seems to us that this space could be devoted profitably to a more thorough didactic exposition. *War Nephritis*, by Bradford, is a good article, but why was this topic chosen? The final three articles on *Diseases of the Adrenal Glands*, by Riesman, *Diseases of the Pituitary Gland*, by Horrax, and *Diseases of the Thyroid and Parathyroid Glands*, by Plummer, are all ably written.

**Dermatology.** By J. DARIER, Physician to the Hospital Saint Louis, Member of the Academy of Medicine, Paris, France; Honorary Member of the American Dermatological Association, etc. *Authorized Translation from the Second French Edition.* Edited with Notes by S. POLLITZER, New York, Ex-President of the American Dermatological Association; Corresponding Member of the French Society of Dermatology and Syphilography, etc. Royal octavo; 769 pages; 208 illustrations. Philadelphia and New York: LEA & FEBIGER, 1920.

Pollitzer has done a service in making Darier's *Précis de Dermatologie* available to the English-speaking profession. The translation, which may be spoken of as an American edition, since it contains many valuable notes by Pollitzer, is made from the second edition of the French work which, in turn, incorporated comments by Judassohn of Berne in his German translation of the first edition. This American edition is therefore largely representative of the dermatologic practice of three nations.

Darier's work is not an advanced treatise for the specialist. It is written as a manual to which the student and the practitioner can turn for an adequate description of the dermatoses and their treatment rather than an exhaustive discussion of their etiology and pathology.

The arrangement of the work is as in the first edition. The first part (22 chapters) deals with Morphology of the Dermatoses, in which are classified and discussed the skin affections that are best described by their appearance, e. g., the erythemata, eczema, the papular dermatoses, keratoses, etc. The second part (9 chapters), Nosology of Dermatoses, considers those skin affections that can be described under an etiological classification,—artificial dermatitides, parasitic dermatoses, bacillary dermatoses, etc. An Appendix is devoted to Therapeutic Notes.

Pollitzer has added much to the value of the work by his many brief comments and occasional longer interpellations. The many illustrations are quite clear, consisting chiefly of well-reproduced photographs. There are four colored plates.

**Dermatology, the Essentials of Cutaneous Medicine.** By WALTER JAMES HIGHMAN, M.D., Associate Professor of Dermatology, New York Post-Graduate Medical School and Hospital; Acting Associate Dermatologist, Mt. Sinai Hospital, New York; Adjunct Dermatologist, Lenox Hill Hospital, New York; Pathologist, Department of Dermatology, Vanderbilt Clinic, New York; etc. Royal Octavo; 482 pages; illustrated. New York: THE MACMILLAN Co., 1921.

Highman's aim has been "to present essentials succinctly consecutively, completely and simply, without sacrificing important detail". Citations from the literature and lengthy histologic descriptions are accordingly omitted. His presentation of the subject is based on a consideration of dermatoses as far as possible from the standpoint of internal medicine. After a chapter on *etiology* are two in which the author tabulates a classification of skin affections. These he divides broadly into the autochthonous and the non-autochthonous, which are grouped as hereditary or con-

genital, and acquired. These are subdivided according to the producing agency, or other etiologic relationship. In the text Highman divides his subject under the following heads: *pure dermatoses*, consisting of five groups, which are described according to the skin reactions—a morphological arrangement; *parasitic diseases and infections*, two groups, including non-infectious granulomata; *neoplasms and nevi*, two groups; *diseases of the organs of the skin and of the mucous membrane*, three groups; and *syphilis*. Highman inveighs, against the term *eczema* and describes the *eczematides* as *dermatitides*, which they are.

"Less important diseases appear in finer type \* \* \* to convey graphically their relative place among dermatoses". A less graphic method would have accomplished the purpose sufficiently well; and this intermixture of larger and smaller type detracts much from the appearance of a book which in other typographic respects has nothing to commend it. We have seen few medical works, in many years, in which the type selections for headings and sub-headings are so displeasing to the eye and so unhelpful. The choice of paper is correspondingly bad. The dull, unbleached pages on which the text is printed look all the worse by contrast with the white, finished pages on which are the half-tones (photographs) with which the work is illustrated. These are from the collections of Dr. John Fordyce and Dr. George Mackee. Instead of being opposite the text they illustrate, these photographs are gathered together in groups of four to ten pages and crudely "tipped in". This appears to us to have had no other purpose than economy of make-up. The pasting and binding workmanship are in keeping.

In reviewing books we rarely refer to these details, partly because they are less important considerations than the contents, but chiefly because nowadays medical books are usually printed in a manner that is pleasing and attractive if not, indeed, artistic. We could not refrain, however, from criticising the make-up of this manual for it seems a great pity that what is so good in substance should be made to appear so bad in form.

**Functional Nerve Diseases.** An Epitome of War Experience for the Practitioner. Edited by H. CRICHTON MILLER, M.A., M.D., Formerly Medical Officer in charge Functional Cases, No. 21 General Hospital, Alexandria. Late Consulting Neurologist, 4th London General Hospital. Duodecimo; 198 pages. London: HENRY FROWDE, HODDER & STOUGHTON, 1920.

An excellent volume picturing the origin and nature of the functional neuroses. The contributors have been allowed to maintain their individualities and in consequence there are varied interpretations of the same phenomena but fortunately without lessening the value or helpfulness of the general content.

The Summary by William McDougall suffices to readjust the differences so that there is a clear understanding of the nature of the psychogenic factors and the basic physical and mental phenomena involved in functional disorders.

The book takes a sane middle position with reference to most of the moot points in dynamic psychology.

The articles are on a remarkably high plane and combine to make the volume a distinct contribution to the literature of neuroses.

Incidentally, a word of praise is merited for the introductory analyses of each chapter which greatly facilitate an appreciation of the text.

**Feebleness of Growth and Congenital Dwarfism, With Special Reference to Dysostosis Cleido-Cranialis.** By DR. MURK JANSEN, O.B.E., Lecturer on Orthopedic Surgery, University of Leiden, Holland. Octavo; 82 pages; illustrated. London: HENRY FROWDE, Oxford University Press; HODDER & STOUGHTON, 1921.

An interesting little volume interpreting feebleness of growth as due to toxic influences and fatigue arising in pregnancy acting upon the fetus. The second section is devoted to congenital dwarfism, which is regarded as a special case of feeble growth due to compression and ischemia of flexible parts of the embryo and fetus. This is a valuable contribution to the study of the mechanical malformations arising during intra-uterine life.



# American Journal of Surgery.

## QUARTERLY SUPPLEMENT of ANESTHESIA & ANALGESIA

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### July      CONTENTS OF THIS ISSUE      1921

SURGICAL ANESTHESIA AMONG BRITISH TROOPS IN THE TROPICS	L. M. Routh London, Eng.	66
PROLONGED ORAL ADMINISTRATION OF NITROUS-OXYGEN IN NEUROLOGICAL OPERATIONS	George W. Tong Brooklyn, N. Y.	67
PROLONGED NITROUS OXID-OXYGEN AND MINIMUM ETHER ANESTHESIA FOR NEUROLOGICAL OPERATIONS	Otto Warner Washington, D. C.	70
ANESTHESIA FOR OPERATIONS IN CHILDREN	Edward W. Beach Philadelphia, Pa.	71
THE SELECTION OF THE ANESTHETIC FOR INTRAORAL SURGERY	C. H. Burmeister Cincinnati, O.	75
ANTAGONISTIC ACTION OF CAFFEIN TO GENERAL ANESTHETICS	Wm. E. Burge Urbana, Ills.	76
ADMINISTRATION OF CARBON DIOXID AFTER ANESTHESIA AND OPERATION	Stanley P. Reimann Philadelphia, Pa.	77
AIR CONTROL AS A MEANS OF REDUCING THE POSTOPERATIVE DEATH RATE	E. Huntington New Haven, Conn.	82

### DEPARTMENTS

EDITORIALS	91	SOCIETY PROCEEDINGS	93
BOOK REVIEWS	93	QUARTERLY INDEX	94



# ANESTHESIA IN WAR SURGERY

## SURGICAL ANESTHESIA AMONG BRITISH TROOPS IN THE TROPICS (INDIA).

LAURENCE M. ROUTH, M.D., B. C. CANTAB.

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In publishing his opinions originally in the *British Medical Journal*, October 11, 1919, Laurence M. Routh emphasizes that the art of inducing and maintaining anesthesia among Europeans in the Tropics has definite characteristics distinguishing and complicating the action of general anesthetics in contradistinction to their administration in England.

During the last three and a half years I have been in India, and most of that time in Bombay, where in the various war hospitals I have had ample opportunity (in the capacity of specialist in anesthesia for two years) of noting the mode of action mainly of ether and chloroform.

### SPECIAL CONSIDERATIONS.

Of recent years it has been more fully realized that a skilled anesthetist is as necessary as a skilled surgeon; and this obtains more especially in the tropics, where climatic and temperamental vicissitudes prevail. The Bombay war hospitals are devoted almost entirely to troops invalided from field service, and in the vast majority of cases from Mesopotamia. As in France, so in greater degree in Mesopotamia, the strain of active service has the effect in many instances of inducing a highly nervous condition, especially in the highly strung and primarily neurotic subject, but evident also in the phlegmatic temperament. In my opinion, in the tropics the subject calling for special care in anesthesia is the thin and anemic youth of from 18 to 25 years, perhaps recently out from home and unacclimatized, and particularly the young officer who has had much responsibility thrown on his shoulders, where an error of judgment in the front line might court disaster. Of the two, it is rather the full-blooded beer drinker that I would prefer to have to anesthetize in the tropics; he will doubtless cause trouble during induction, from struggling, but he will be unlikely to display evidence of collapse and failure of pulse and respiration, or

both, which is always in view in the former type.

Irregular and often unsuitable food while on active service also leaves its mark. In a tropical country the food question is often very difficult, especially in the front lines, for bully beef and biscuits predominate, vegetables are often a rare luxury, and a temperature of 120° F. does not add to freshness of the food or to the comfort of the surroundings.

Excessive smoking also plays its untoward part in predisposing to tachycardia and cachexia. Moreover, the climate and surroundings do not permit of entertainments and healthy sports to the same extent as in a non-tropical zone to divert the soldier's thoughts and keep him physically fit.

### CHOICE OF ANESTHETIC.

*Ether*.—I have been frequently told by medical men in India that ether, at any rate by the open method, cannot be employed in India. This theory I have found to be entirely erroneous. In Bombay, though a moist climate, ether can be administered, either pure by the open method, or as a mixture of ether and chloroform; if pure ether is used I find very little more ether is used than at home. *Up country*, with a dry climate and a temperature well over 100° F., open ether can be given satisfactorily, but it is necessarily somewhat more extravagant than in England owing to the atmosphere. In Bombay, for routine administration I find ether 3 parts and chloroform 1 part a very convenient mixture, and patients remain comfortably *under* with the same ease as with the commonly used C. E. mixture at home—(chloroform 2 parts, ether 3 parts). A further dilution still with ether is frequently advantageous, and in serious cases pure open ether is indicated. Ether has been procurable during the last two years, especially at the war hospitals, but during the later months of 1915 and early in 1916 it was extremely difficult to obtain it suitable for general anesthesia (specific gravity 0.720). The whole supply of ether is imported, and it is mainly owing to the transport difficulty, which in India has been acute, that I have not habitually used pure open ether as at home.

*Chloroform*.—A relatively dangerous drug in the tropics, especially for those debilitated after field service. Its use in the pure state should, I think, be almost entirely confined to operations requiring Junker's inhaler. It predisposes to shock, and the patient is liable to inhale a toxic dose. Chloroform is always easily procurable, and Duncan's White Label is plentiful, and though one has to work with other brands occasionally, I have had no occasion to suspect their quality. It is necessary in such a



climate to keep stock bottles in a cool and dark place.

#### MODE OF ADMINISTRATION.

*Preliminary Medication.*—A preliminary injection of morphin and atropin is convenient in a nervous subject, but generally quite unnecessary even with open ether; the secretion of mucus is usually slight and rarely interferes with the administration; moreover, surrounding the mask with towels or gauze to any extent is superfluous. Should an injection have been decided on, I have found morphin gr.  $\frac{1}{4}$  and atropin gr. 1/100 half an hour before operation satisfactory. The patient should then not be allowed to walk to the theatre, but should be carried on a stretcher.

A degree of disordered action of the heart unnoticeable ordinarily becomes very evident before an operation, the beat becoming markedly forceable, even to a thrill, and various bruits may be present, which disappear when the stage of surgical anesthesia is reached.

Although patients *go under* as easily and as quickly as in England, there is increased danger in the tropics during the induction stage, especially with any struggling, and pushing at this stage may court disaster, particularly with chloroform.

The tendency to failure of heart and respiration seems greater than at home, probably climatic in origin, and is undoubtedly aggravated by the highly nervous condition in which so many patients come to operation.

A somewhat lighter anesthesia can be maintained than in England. The corneal reflex is rarely lost, its presence even during the primary skin incision seems to have little effect. In one instance, as far as I am aware a unique one, at the close of the operation when the patient was coming round, but with no evidence of retching, he suddenly sneezed; this was followed immediately by complete cessation of respiration, which had to be maintained artificially for over five minutes, with ultimate recovery. The pulse was good throughout.

*Sweating* is often profuse, especially in a subject in a bad condition; this is undoubtedly largely climatic for this reason; a fan is contraindicated in a theatre if a laparotomy or other serious operation is in progress.

*Pituitrin* is a drug I have found it necessary to resort to more frequently during operations than at home, with the same valuable results in augmenting the heart's action and countering shock.

*Postanesthetic vomiting* is rare and never troublesome, but a little retching before leaving the

table is common. I have seen no case of post-anesthetic acidosis or delayed poisoning in the tropics.

*Nitrous oxid* is little used in India, but anesthesia with it is in every way satisfactory. The gas is now made locally, but is rarely obtainable except for dental work.

*Ethyl chlorid* I have never seen used in India as a general anesthetic; it is too volatile for the climate.

In the course of a considerable experience in India I have been perhaps fortunate in having no fatalities. Extreme care, continual watching of the patient, maintaining an even anesthesia, and the use of a suitable anesthetic or mixture, together constitute in my opinion the secret of obtaining satisfactory results in the tropics.

#### THE PROLONGED ORAL ADMINISTRATION OF NITROUS OXID-OXYGEN IN NEUROLOGICAL OPERATIONS.\*

GEORGE W. TONG, M.D.,  
BROOKLYN, N. Y.

Just as the occurrence of various nerve injuries, resulting from war wounds, was the cause of much study in their surgical repair, it was, likewise, the reason for a search after an anesthetic which would be suitable in these reparative operations, involving neurolysis, nerve suture, nerve-grafting or cabling according to the conditions found after incision.

#### CHOICE OF ANESTHETIC.

In these nerve repair cases there was very little question as to the choice of anesthetics or the comparative advantage of nitrous oxid over ether or chloroform as modified by some pathological condition in the patient's body. The subjects for operation, as a general rule, were organically sound, and, in the rather prolonged period in which they had been under hospital care to render their wounds aseptic and resistant to the expected operative trauma, they might be also supposed to have increased their resistance to anesthetic agents. In fact, the great surprise to one not acquainted with the work was the completeness of the anesthesia produced by such a light agent as nitrous oxid among a body of men of strong physique and rugged health (outside of the nerve injury), and I must admit as a personal experience that until we had learned the fact in the first month or two, I was

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society, William Penn Hotel, Pittsburgh, October 5-7, 1920.



always prepared to shift to some other anesthetic as soon as signs of unsatisfactory anesthesia developed and persisted.

As this is a paper based on clinical experience, I can probably bring you no new ideas as to theory; whatever I can hope to do in a meeting of this sort where all have practical experience, is to emphasize some of the points which you have already recognized as familiar Bible texts in practical administration.

#### PSYCHIC PREPARATION.

We have all seen the patient, apparently resigned to the approaching operation as far as words and external actions are concerned, but inwardly apprehensive and not at all properly prepared. Sometimes he gives us unknowingly a warning of the condition before the induction is begun, and a little later the instinctive effort at self preservation comes to the surface as soon as the conscious control of these repressed impulses has been put to sleep. Age, sex, size or temperament seem to make little difference in their reactions; if the mind is under proper control of the anesthetist, the problems, especially of the induction, are much simplified.

This was the element that made the anesthesia so successful. An army hospital is in some ways like a sewing circle where topics of interest are passed from mouth to mouth, and the work that is done in the operating room is, of course, a subject of special interest to those who are to take their turn later. At first there was the element of exaggeration to deal with. In the days when ether was the anesthetic, the men who were sickest after an operation usually had the most to say about their sensations, and it was a little surprising and perhaps disappointing to some of them to have so few after-symptoms following the nitrous oxid. However, the novelty of this soon wore off, and the men went into the operating room expecting from the experience of their predecessors no discomforts from the anesthesia.

The operations were always considered as a part of the treatment and were welcomed as an opportunity to get ahead with their cure. The surgeons, in their rounds through the wards, were usually greeted with requests to advance the dates of operations on these injuries; and, if by any chance, the request met with favor, the patient was rejoiced to be so many days ahead in his recovery. No fear, no worry over the operation; only a relief that he would be well so much sooner. I say little about the preparing of the individual patient's mind to

the anesthesia; a few words of encouragement as the mask was being adjusted to the face and the gases started; the larger and more important part of the psychic control was by mass action outside of our sight.

I have gone at some length into this part of the subject, the mental problem, because of my feeling that it may make all the difference between good and bad anesthesia, both during the operation and in post-operative effects, and the lessons learned from this work in a selected group of cases may well be carried back to civil life. If the application later on is not attended with the same ideal results, we must not blame it then on the administrator or the anesthetic agent, (the duo usually held responsible for all shortcomings in the operative team,) but more often on the human material which is given us to take charge of for a time, and which may not be in ideal condition either as to mind or body.

#### OUTSTANDING FEATURES.

What were the outstanding features of the work? As suggested before, the ease with which a group of men, who might be considered rather difficult to anesthetize, were carried along is of great interest, and the second consideration, which also attaches to the anesthetic agent itself, was the length of time of the operations. Dissection of nerves is necessarily a careful time-consuming business, and the anesthetist had to be prepared for an operation measured in hours; in fact the longest operation lasted very nearly five hours and the shortest ones averaged between two and three hours, yet the usual unpleasant feature after a prolonged anesthesia were always absent. The patients woke up promptly and were ready for the inevitable cigarette soon after they returned to bed.

#### ESSENTIAL POINTS IN MAINTAINING SMOOTH ANESTHESIA.

The method of applying the anesthesia presents no new ideas to those who have been working with nitrous oxid, but a review or restatement of the essential points in maintaining smooth anesthesia may not be out of place. *The respiratory rhythm is the essential study in these cases; any alteration in depth or rate requires instant correction, but in this particular preventive care is of more importance than later correction. This means strict observance of and attention to every inspiration, to note the slightest change in character instead of the desultory attention which occurs so frequently in ether anesthetics.* The pulse and circulatory phenomena are of secondary importance, needful of



attendance, but as the pulse rate does not drop down to its preoperative condition when at rest until anesthesia has been maintained for some time, worry over varying rates of cardiac action is usually unnecessary. The circulatory phenomena are so much better under control with the oxygen at hand that they seldom make any trouble or cause any anxiety.

There are two essentials in the management of this anesthesia. First and foremost must be considered the accurate fitting of the face mask so that all outside air is excluded and the patient's respiratory exchange of gases is absolutely controlled by the anesthetist. Even the slightest leakage of air into the apparatus disturbs the smooth conduct of the anesthesia and causes continual changing of the percentage of gases. And as the reverse of the condition a tight fitting face piece renders the anesthesia almost automatic after the first fifteen minutes have determined the patient's quantitative need of oxygen in the mixture.

The second consideration in efficiency is rebreathing of the gases. Of course the question of expense is not to be considered in comparison with the patient's safety, but, since the studies of Gatch and McKesson on rebreathing some years ago opened up the subject, proving its harmlessness and in some cases its actual value, and have been followed by a larger clinical experience to confirm the early statement (one of the refreshing cases in medical teaching where theory has been fully supported by later clinical work), this method has been employed to its extreme, even in cases of four and five hours' duration. The results speak for themselves, not only in the negative virtue of harmlessness but in the absence of exaggerated breathing and other allied disturbances which unite to form the complex symptom of shock.

#### ADJUNCTS.

Nothing much remains to be said as to the actual methods of inducing and maintaining anesthesia. This is all an old story to you. The oxygen reserve in the patient's lungs and tissues is first reduced by the administration of nitrous oxid alone until the color shows a slight change from its ruddy pink. Oxygen is then added to continue the color short of cyanosis. If any condition exists which contra-indicates the addition of other agents to deepen the anesthesia, the mixture is varied slightly with less or more oxygen to reach the required depth of anesthesia; if not objectionable a small amount of ether is given from time to time during the first ten minutes to assure a satisfactory muscular relaxa-

tion, and with the rebreathing method a surprisingly small amount is required (generally a couple of drachms). After this stage it is very unusual to add any more ether no matter how long the operation may be. After the skin incision is finished and the work among the muscles and nerves, whether functioning or destroyed, has commenced, a light anesthesia seems to provoke no reflex.

#### OXYGENATION AND OOZING.

One of the objections to the use of nitrous oxid has been that there is likely to be more oozing than with other agents, and this would be a very troublesome item to deal with in operations which require so much careful dissection as the group of nerve injuries with their much-distorted anatomical relations. My own feeling in the matter has been that the excess of nitrous oxid in the tissues has been the cause of this ooze and that sufficient oxygenation would be the remedy. By applying this reasoning to the anesthesia this unpleasant feature has been eliminated, the blood has been kept a bright color and the operative work not increased by continuous sponging away of blood.

#### ORAL ADMINISTRATION.

The oral administration left something to be desired in one class of cases, where it was very difficult to maintain the first essential of satisfactory anesthesia, *i. e.*, an air-tight face piece. Operations requiring a lateral or prone posture find the anesthetist devoting most of his attention to keeping the face cuff in position when the head is buried in the table, and, more important, not having the time to devote to the proper administration of the gases. After many troublesome hours the difficulties of posture were cleared away by having a pharyngeal tube made up with a rubber flap fitting around the tube which was placed between the gums and the cheeks; a slip joint with an exhaling valve at its end attaching the pharyngeal tube to the regular gas bag. Then by plugging the nostrils with cotton the patient's air supply was perfectly controlled, and all the mechanical difficulties connected with the face covering were done away with in all those cases in which the position (from an anesthetic standpoint) have been so troublesome.

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MAKE YOUR PLANS NOW TO ATTEND THE ORGANIZATION MEETING OF THE MID-WESTERN ASSOCIATION OF ANESTHETISTS, IN KANSAS CITY, MO., OCTOBER 24-28, IN CONJUNCTION WITH THE MEETINGS AND CLINICS OF THE MEDICAL VETERANS OF THE WORLD WAR, AND THE MISSOURI VALLEY AND SOUTHWESTERN MEDICAL ASSOCIATIONS.



# PROLONGED NITROUS OXID-OXYGEN AND MINIMUM ETHER ANESTHESIA FOR NEUROLOGICAL OPERATIONS:

## CASE REPORTS.

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The following case reports are presented to show the value of nitrous oxid-oxygen and minimum ether anesthesia for prolonged neurological operations.

CASE REGISTER No. 21916.—Patient G. W., aged 26, white, 12 months service. Diagnosis old gunshot wound of the inner surface of the right arm, sustained in action in the Argonne, October 8, 1918. Immediate operation, September 2, 1920, for complete interruption of the median and ulnar nerves and partial interruption of the musculo-cutaneous nerve. The operation included liberation of the proximal segments of all three nerves and the distal head of the ulna. Also implantation of the musculo-cutaneous and fixation of the median and ulnar nerves with general excision of all scar tissue. The amount of ether used was 390 cc., and the duration of operation was 5 hours and 20 minutes.

On February 25, 1920, the final stage operation for complete interruption of the median and ulnar nerves of the right arm was performed in order to make a multiple nerve transplant. Nitrous oxid-oxygen and minimum ether was the anesthetic used and the duration of the operation was 7 hours and 45 minutes, during which time 10 cc. of ether were required.

CASE REGISTER No. 15639.—Patient —, aged 20, white, rank, wagoner. This patient, on October 30, 1918, received a gunshot wound, in the line of duty at Ypres, which injured the right median, ulnar and lesser cutaneous nerves. The first operation was performed September 5, 1919, for approximation and fixation of the divided nerve segments preliminary to grafting. Ether was the anesthetic used and 390 cc. were employed during an operation lasting 4 hours and 15 minutes. A second operation was performed October 9, 1919, for excision of scar tissue over the site of operation. Ether was again the anesthetic used and 400 cc. were consumed during the operation which lasted 3 hours and 10 minutes. A few weeks later a third operation was done for the release of a pedicle in an old skin graft of the upper right arm, at which time 5 cc. of ethyl chlorid were used to induce

anesthesia and 40 cc. of ether were used to maintain anesthesia for an operation lasting one hour and 18 minutes.

The final operation was performed on January 3, 1920, for complete interruption of the ulnar, median and proximal stump of the internal cutaneous nerve. It was proposed in this operation *first* to liberate and suture the right ulnar nerve; *second* to liberate and graft the right median nerve and *third* to liberate the proximal stump of the internal cutaneous nerve. Nitrous oxid-oxygen and minimum ether anesthesia was employed, 30 cc. of ether being used during the operation which lasted 8 hours and 10 minutes.

Both these patients made prompt recoveries, despite the prolonged duration of their operations, without nausea or vomiting or any other untoward effects.

A number of similar instances could be mentioned, but the case reports presented are good illustrations of the results obtained in prolonged neurological operations with nitrous oxid-oxygen and minimum ether anesthesia, when the patients were poor subjects for ether *alone*.

The patients mentioned were operated upon at Ft. McHenry in addition to many others in various hospitals. Most of the neurological operations performed averaged from 2 to 3 hours in duration and some were much more prolonged, but in all the use of nitrous oxid-oxygen minimum ether anesthesia was found to be especially suitable and free from postanesthetic effects.

The following case, from the records of the Walter Reed Hospital, is an evidence of the value of this method of anesthesia in safeguarding patients who are hazardous risks. The patient was a young woman presenting for an exploratory laparotomy and salpingectomy (clamping off and removing ruptured tube) for ruptured ectopic pregnancy. The patient, previous to operation, was pulseless and in a condition of extreme shock, her systolic blood pressure being 65 and distolic 35. Nitrous oxid-oxygen and minimum ether anesthesia was administered and satisfactory relaxation obtained with smooth, even maintenance of anesthesia throughout the operation. The patient made an immediate recovery from the anesthetic and an uneventful convalescence from the operation.

PROVIDENCE HOSPITAL.



## ANESTHESIA FOR OPERATIONS ON CHILDREN.\*

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Probably there is a subconscious thought that passes through the minds of most anesthetists, be they skilled or otherwise, that if the patient is a child there are not quite so many dangers and worries to be contended with. There is no doubt but that from a physical standpoint both the surgeon and anesthetist consider such cases as more or less easy ones.

If one is to look upon the administration of any type of anesthesia from the standpoint of ease he is likely to find trouble sooner or later. To successfully give an anesthetic to a child, no matter what the operation may be, the same hard and fast rules apply as in the case of an adult. It is true that one does not have to consider and plan for certain contraindications in children, such as nephritis, myocarditis, high blood pressure and other conditions which come to many later in life. It is also true that there are less of the so-called major operations performed in the early years of life but the fact is that while operations may be minor in character, each and every anesthetization is a major one.

## ESSENTIAL POINTS IN ADMINISTERING ANESTHETICS TO CHILDREN.

It is the object of this paper to consider the necessary points, which the writer considers essential to the administration of any one of the various agents used as anesthetics in children up to the age of twelve years.

There are many seemingly small details, which when taken together go to make up a successful anesthesia from the standpoint of all concerned.

The relationship of the dose of anesthetic necessary, to that of the body weight is practically as in the adult, but the child is found wanting in reserve strength. The younger and smaller in size so will be the lack of resistance to the shock that attends operative procedure, and especially long ones.

The child is of a peculiarly nervous development and this fact often causes the nervous reflexes to differ considerably from those in the adult. Again they are highly prone to surgical shock and while the prolongation of certain operations in the adult would give us little or no concern, in the young this fact is an element to be considered.

The air limitation, which is small in the children,

is marked and taken together with the fact that syncope is more often seen in this class of patient, must be considered.

All of these points make it necessary that the time of anesthesia be as short as possible and no time be lost by the operator in any unnecessary delays.

Probably a preliminary visit by the anesthetist to become acquainted is more helpful than even in the adult. He can learn a great deal by a few minutes of playful visit. He can ascertain from the parents or nurse some of the interests of the child, make a note of the physical development and general resistance, an approximation of weight, the possibility of nasopharyngeal obstruction and other necessary data, which all help in his choice of the best, as well as safest, agent to be used in that case.

The question of preliminary medication is one that must be considered from two angles, immediate and postoperative.

The fact that young children so often show peculiar results from opium and its derivatives make it best to give this drug only in a certain number of older children and even then only when there is a positive indication for its use.

Atropin is always given in conjunction with morphin and as it is much better borne it may be used alone, which will also help to control the secretions that often cause trouble and delay, especially in children.

The well-known fact that children are prone to acidosis following anesthesia makes it necessary that we use some preventive measures when able to do so. This is best done by suitable doses of sodium bicarbonate, for example, 1.5 to 2 gr. for each year of age, three or four times a day, for three days before operation.

Tact is a most essential qualification to one's success and more so than in the older person, who realizes that the anesthetic is a necessary part of the whole procedure. After the agent to be used has been decided upon and the preliminary necessities carried out, the actual administration is next.

## TECHNIC OF ADMINISTRATION.

The administration of any anesthetic to a child should be undertaken with the greatest possible care. The patient must be well covered, dry and warm, because in children the loss of body heat is proportionally far more rapid than in the older. There should be no show of restraint, if possible, but if the child is too young for any reasoning or is stubborn and self-willed, there is no reason to delay in inducing unconsciousness as rapidly as safety permits. The signs of approaching dangers are to

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society William Penn Hotel, Pittsburgh, October 5-7, 1920.



be seen in children as easily as in grown persons but they are quicker and more transitory, therefore watchfulness is very essential. It is always the wisest plan, if possible, to begin any of the anesthetics slowly, all the time trying to divert the child's mind from the immediate proceeding, a few minutes more spent by slowly inducing narcosis is well repaid by the decreased period of excitement and its attendant dangers.

In the case of the child, as in the adult the question of choice is one that causes some question in many operative procedures. The agents used are the same and the methods practically alike but it must be remembered that several elements enter into child anesthesia that are not encountered in the administration to the adult. The writer feels that there is no set rule that the anesthetist may go by in his choice.

There must be a careful weighing and balancing of facts before the final choice is made, and certainly, it should be the judgment of the anesthetist that is followed rather than the wishes of the surgeon, or the desire to save the patient an unpleasant experience.

The only time the various methods of local or spinal anesthesia are to be used is when a general anesthetic is contraindicated. Any of the methods which do not produce a loss of consciousness are of little value in the case under twelve years of age.

The element of fright and nervousness is often marked in the grown-ups and is certainly 100 per cent. present in the child. The success of such methods depends somewhat upon the help and co-operation of the patient and this help is found wanting in the small one. For these reasons alone we may pass on to the more common methods.

*Ethyl Chlorid.*—It is difficult to arrive at any definite conclusions regarding the safety of this drug. Some authorities look upon it with favor and equally good ones with disfavor.

The writer's experience with it in children has been unsatisfactory, while it has some advantages in very short simple surgical procedure, there can be no doubt that when used over any length of time it is with difficulty that an even anesthesia is maintained. The respirations which are so important in the young are particularly prone to disturbances especially of rhythm, and these seem to be most subjected to accidents, to be followed by a failure of the circulation.

Ethyl chlorid has what one may call an accumulative effect which causes an over-dose effect even after the anesthetic is discontinued. The rapidity with which it affects the child and the ease with

which an over-dose is acquired, even when the greatest care is exercised, makes it a dangerous drug. In the writer's experience standing first as the most dangerous except when nitrous oxid is used in the very young.

*Chloroform.*—It is only within recent years that chloroform has been regarded in its true light in children. There was a time, not far past, when the impression prevailed that children were less likely to any toxic action from chloroform. The fallacy of such a statement has been proven too many times to leave a shadow of doubt.

The very young are peculiarly liable to dangers both during the induction and later in such after effects as acidosis, and changes in the liver.

*During Induction.*—The child is prone to crying and struggling which leads to alterations in the respiratory action varying between holding of the breath and the full deep inspirations to be followed by a sighing shallow respiration, all of which make anesthetization both difficult and dangerous.

The deep full inspiration with its possibility of an overdose is well known to all of us. Again the baby may only literally go to sleep under chloroform and often it is with difficulty that we are able to differentiate between this so-called *false* anesthesia and *true* anesthesia.

The tendency of the young to go into a condition of syncope during what seemingly is a satisfactory administration is another danger to be contended with. This probably is due to a lowering of the blood pressure which always occurs in chloroform anesthesia. Also the possibility of syncope must be guarded against even after the anesthetic has been discontinued, by keeping the head low in moving the patient and after the return to bed.

The only advantages to the child are quickness of induction with a saving of time, taken together with the lessened irritation of the nasopharynx and bronchial tract. In the administration unusual care must be exercised and a large percentage of air or oxygen used with the agent.

I do not condemn chloroform because I believe it has a place in surgery, but it should be employed only when there is a positive indication and then only by a skilled person.

As a preliminary to the continuation by ether the same dangers are encountered as in the induction, and the lessened fright and irritation do not counterbalance the risk that is taken by its use.

*Ether.*—When we consider this agent from the standpoint of an anesthetic the first point is, that of all such drugs used, it is the one that acts as a stimulant from the beginning until late in a pro-



longed operation. All children, as we know, show the loss of body heat, and of blood; are more prone to shock and have less resistance than the adult, facts which must be considered.

This taken together with the fact that it is one of the safest agents used, shown by all mortality statistics, makes one hesitate before eliminating it as our choice. On the other hand, it is also true that ether has a decidedly irritating effect upon the mucous membranes of the respiratory tract, also that in children this irritation is more marked than in the older person. This irritating property of course causes more postoperative complications than when other anesthetics are used. If a minimum amount is used and care exercised as to maintaining body heat during the operation, and if the same care is used in transporting the patient back to the bed and even after, then this danger is reduced to a negligible consideration.

In the administration we probably have a wider and more varied choice as to the method used than with other agents—namely, the open, the closed and a combination of both.

As to the first or open drop method, this plan is the safest and easiest in a great percentage of routine cases. The use of several layers of plain gauze either with or without one of the various types of masks, together with the ordinary  $\frac{1}{4}$ -pound can of ether, is certainly to be recommended and more so in the majority of cases where the one administering the ether is not especially trained. This method is as near fool-proof as any. The gauze held away from the face and gradually lowered as the irritation is lessened, together with a little patience on the part of the anesthetist, is certainly to be recommended as a routine method.

By this manner the risk taken by the administration is very small. There are numerous signs and symptoms that tell of the dangers of an overdose and plenty of time to correct them.

As to the closed method which is more often seen in the larger children or early adolescence. There are times and conditions which may indicate the use of an inhaler of which to my mind the Bennett is the most satisfactory, but with the child, the fear encountered by the use of a close face piece, the difficulty of obtaining a face piece to fit the smaller and varied types of faces seen in the child, must be considered, before the closed method is chosen. With this method rebreathing is essential for at least part of the time and this constitutes another objection because of the poor manner in which children stand rebreathing.

With ether as the anesthetic the ideal method is

one that reduces the amount of irritation, and uses the smallest amount of agent, together with the least amount of effort by the patient.

This is probably best obtained by a warmed vapor, which can be given in a gentle regular flow of the gas, and so throws no extra work upon the respiratory apparatus of the patient.

There are so many methods and manners of doing this that it is unnecessary to go into detail excepting to caution against any apparatus that is not sure of delivering a warm vapor.

In children a large percentage of operations are upon or around the nose and mouth. For such the nasopharyngeal method is to be recommended for two reasons; *first*, the surgeon may work continuously and in so doing shorten the time of anesthetization; *secondly*, this eliminates what is called intermittent anesthesia. There is no question but that this manner of administration is harmful. It causes too much variation as to the depth of narcosis. The secret of good anesthesia is evenness in maintenance, and one cannot do so in any intermittent fashion.

*Nitrous oxid-oxygen.*—At the present time there is probably more interest taken in this manner of producing surgical anesthesia than any of the others. There has developed a feeling among the profession that this combination is without dangers under all circumstances, and I think it is time that the falseness of this feeling is shown by those who know differently. Statistical tables show a very, very small mortality but now that this method is used for major surgical work there is bound to be a greater mortality.

Nitrous oxid is the safest anesthetic now being used especially when the operation is a short one. Nevertheless, in the hands of an inexperienced anesthetist, it is a dangerous combination and this fact is especially true in children.

Whenever nitrous oxid is used in the child there is one cardinal principle that to my mind must be adhered to,—*namely*, at all times oxygen must be used in conjunction with it.

The period of childhood may be divided into three groups,—up to 6 years, from 6 to 8 years, and from 8 to say 12 years of age.

At all times there are circumstances and conditions, which have a direct bearing on the choice of this combination as an anesthetic. Always the general physical development must be considered. There is a direct ratio between the development and the physical stature to the safety of nitrous oxid. A child may be 10 or 12 years of age and be a thin, emaciated, anemic subject, so warning against the



choice of gas, while on the other hand one of 6 years may be as a child of 9 in development. The surgeon, type of operation, the surroundings and the ability of the person in charge of the anesthetic must also be considered, before this rapid acting agent is chosen.

In the very young nitrous oxid is not to be used. The well known asphyxial element seen when this gas is used is in itself a contra-indication up to at least 6 years. Another reason why these individuals cannot take nitrous oxid is due to their thin poorly developed chest walls, which cannot properly overcome the demands made upon them by the valves of the inhaler.

Again, the so-called tidal volume of a child's breath is very small and this fact makes the normal *to and fro* volume of nitrous oxid with the carbon dioxid gas cause difficulty in maintaining an even anesthesia. The carbon dioxid which acts as a respiratory stimulant or at least as an exhilarant to the respiration is probably the cause of this irregularity.

From the age of 6 or 7 there begins a time when nitrous oxid may be used with certain qualifications. Of these the greatest factor is a skilled trained anesthetist. The operation should be performed under circumstances that guard against accident, such as in a hospital where there is help if need be.

The young person will in a big majority of cases object to the face piece and this objection may be the cause of a beginning nervous condition which will show itself after the induction has really occurred.

Nevertheless, there is a decided place in surgery for such an anesthetic, as in many of the short operations where a deep narcosis is not necessary; where there are positive contraindications against the use of other agents; where the child is well developed with no obstruction to the air passages, and there is no indication of an unusual glandular enlargement or status lymphaticus; then we may use this combination to the best advantage. As a preliminary to ether it will shorten the total time consumed. It will cause less mucous and saliva and will allay the fears of both patient and parents. As the age increases, so the dangers from nitrous oxid oxygen decrease providing the physical stature equation is a proportionate one. Under these conditions there is no reason why the child should be considered any differently than the adult.

*Ether-Oil Colonic Anesthesia.*—Before concluding I would like to call your attention to Ether-oil

colonic anesthesia. In children this method is hardly used enough as yet to be sure of its position. The indications are the same as those for the adult, and it does work happily in a number of cases. The method as shown by Dr. Gwathmey is satisfactory in all respects, especially in the fact that the bowel may be emptied quickly.

In children the success of an anesthesia is due to the ability to control the amount in the system and unless one has such a control any colonic method is hazardous.

#### CONCLUSIONS.

My effort has been to try to emphasize some of the points which must always be considered when dealing with children from this phase of surgery.

Surely the time has passed when one anesthetic will do for all cases and now one of the essential duties for the anesthetist is that of choosing the safest agent to be used, for everything else is subsidiary to safety. The one agent which stands foremost in this respect is ether.

In children in the larger percentage of cases ether given slowly by the open drop method, with plenty of air or oxygen is the one to be chosen.

1. It is a stimulant against the other depressants.
2. The length of time for induction is very slightly increased.
3. When care is exercised the irritation is small, and the after-effects are transitory.
4. There are plenty of premonitory signs to an over-dose.
5. Lastly, by all statistics as to mortality it has been proven the safest under all circumstances in the usual every day run of cases.

5052 WALNUT STREET.

The following was the motto on the membership cards of the American Anesthetists for 1921:

WHAT IS THE LURE OF ANESTHESIA? TO MY MIND IT LIES CHIEFLY IN THE VARIETY OF THE WORK. THE PROBLEMS ARE ALMOST ENDLESS; THEY ARISE FROM THE STATE OF THE PATIENT, THE NATURE OF THE OPERATION AND THE SPECIAL DEMANDS OF INDIVIDUAL SURGEONS, ALL OF WHICH MAY BE, TO A CERTAIN EXTENT, ASCERTAINED BEFOREHAND. ON THE TOP OF THEM ALL, HOWEVER, IS THE PATIENT'S IDIOSYNCRASY—AN UNKNOWN QUANTITY. THERE IS THUS A SPORTING ELEMENT IN THE SPECIALTY, IT IS A GAME OF SKILL IN WHICH THE MORE ONE GRASPS THE RULES AND THE PROBABILITIES THE MORE ONE PLAYS IT WITH CHANCES OF SUCCESS.

—G. A. H. Barton



THE SELECTION OF THE ANESTHETIC  
FOR INTRAORAL SURGERY.\*

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The actual administration of an anesthetic for dental and oral surgery is far different than one would suppose from reading the regular text books on the subject. Conditions peculiar to operations in the mouth change the rules for the administration of anesthetics for operations on other parts of the body. The admixture of variable quantities of air, the presence of profuse hemorrhage, the small field of operation and the highly specialized sensitive organs demand a technic quite different. In the following paper an attempt will be made to review briefly the indications for various anesthetics and their several uses in operations which are performed intraorally.

## THE ROLE OF LOCAL AND CONDUCTIVE ANESTHESIA.

Local and conductive anesthesia are especially indicated in those operations where careful technic is required. Such an operation as the removal of the impacted third molar seems to be a direct indication for the use of novocain. Some one has said "the more difficult the impaction the more conductive anesthesia is indicated". By the use of the mandibular injection, supplemented by the buccal injection, a painless operation can be performed, one which does not predispose the patient unnecessarily to the risk of ether or chloroform. The field of the operation is clear from blood, and instead of being subjected to the usual nauseating recovery, the patient can be discharged almost immediately. The great majority of impacted teeth operations are not of such consequence as to require the usual hospital routine. Correct angles by the radiograph change many so-called hospital cases into simple extractions.

## TROUBLESOME OPERATIONS.

One of the most troublesome operations the dentist has to perform is the removal of pulpless teeth. It has been estimated that a vital tooth can be compressed one tenth of its bulk and return to its original form. A tooth that has been divitalized can be compressed only 2 per cent. of its bulk. Surrounding the brittle pulpless tooth is a condensing osteitis of the process which makes a far difficult environment than normal. McGee has likened the operation to "the removal of a fossil fish from a piece of granite". Henahan has described the removal of such a tooth as the most difficult he has to perform. The careful turn-

ing back of the flap, the removal of the buccal plate, the tedious dislodging of the fractured apical third by the chisels requires ample time to do the operation without unnecessarily damaging the surrounding structures. This is another direct indication for the use of novocain.

In the removal of infected granulomatous areas about the roots of pulpless teeth, Hartzell says it is his custom to remove the entire tooth and by the use of adrenalin and packs see to it that every particle of the granulomatous tissue is removed from the periapical region. The use of general anesthesia seems especially not indicated in this operation.

A troublesome complication in the removal of the superior molar teeth is the possibility of forcing them into the cavity of the antrum. From anatomical specimens it has been shown that it would be impossible to extract certain roots without entering the cavity. When this occurs the easiest and best way is to remove the buccal plate of the alveolar process, after first making a flap and remove the foreign body by curette, wire loop or by irrigation. The flap can then be brought down and an opening of long standing be avoided. Such an operation could hardly be performed except under a local anesthetic.

Another operation which is being done for prosthetic purposes is the one known as alveolectomy. The principle involved is the removal of as much of the alveolar process as would eventually be removed by nature in the process of resorption. The technic consists in raising a muco-periosteal flap following the extraction of the teeth and with the rongeur forceps excising the buccal and labial alveolar plate and as much of the septal bone as is necessary for the contour. The lingual plate is left as it appears or is smoothed off. If an impression is desired the flaps are sewed together. The men who are doing the work along this line are almost unanimously in favor of local anesthesia. In preference to general anesthesia. This allows the impression to be taken immediately after the operation, which would be otherwise impossible.

Conductive anesthesia is used to advantage in the reduction of fractures, where the break is distant from the point of injection. Relaxation of the muscles is gained without the usual nausea and vomiting following the use of a general anesthetic.

The use of suggestion when local anesthesia is used is of inestimable value. Many operations can be successfully performed under this form of anesthesia by the careful operator where one, possessing equal skill but less tact, is doomed to failure.

\*Read during the Seventh Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the Odontological Society of Western Pennsylvania, at Pittsburgh, October, 5-7, 1920.



## ADVANTAGES OF GENERAL ANESTHESIA.

Nitrous oxid-oxygen is the safest of all general anesthetics in the hands of the expert and the most dangerous in the hands of the unskilled. In the every day practice of Exodontia and Oral Surgery nitrous oxid-oxygen is somewhat limited in its use. It is especially adapted to short operations. In the extraction of vital teeth, not liable to fracture, it is an ideal anesthetic. It is also especially indicated in lancing abscesses and the extraction of abscessed teeth. The method of nasal administration is most frequently used and, allows the operator a clear field of operation. For children and neurotic patients it is the anesthetic of choice owing to the rapid and pleasant induction.

This form of anesthesia has the advantage over local in cases of alveolar abscess as it eliminates the possibility of the infection being infiltrated into the surrounding tissues.

## PROPHYLAXIS OF ASPIRATION.

Dr. Carl Hedblom, in the *Annals of Surgery*, May, 1920, describes some cases in which particles of teeth were inspired during extraction, resulting in the death of the patient in several instances. It is of paramount importance that every available method be used to prevent the entrance of such foreign bodies. Perhaps the best is the packing of the throat method advocated by Winters. Gauze and cotton packs are made by laying a large layer of cotton between two layers of gauze and cutting into four inch squares. A cord about eighteen inches long is tied through the middle of each square. This serves to prevent the passage of the pack into the pharynx and also serves for its easy removal. The patient is anesthetized with the nasal inhaler and the mouth gag is applied and opened when the patient is completely anesthetized. A tongue depressor is introduced and the base of the tongue carried forward. The gauze pack, just described, is passed over the depression and is held firmly in place by the tongue when relaxed. The pack serves two main purposes. It prevents the entrance of foreign material, such as tooth roots, crowns, fillings and blood into the glottis and it also acts as a valve which prevents breathing through the mouth. There have been cases, in which gauze packs not so constructed, have been drawn into the glottis under forced inspiration and removed only with great difficulty. The increased number of accidents of this kind and the inspiration of foreign particles require special attention along the lines of prevention.

## ANESTHESIA FOR PROLONGED OPERATIONS.

In long continued operations such as the removal of large cysts of the upper jaw, cysts of the ramus,

resections, hare-lip and cleft palate, ether is the anesthetic *par excellence*. In intra-oral operations, in which the mouth should be free from anesthetic appliances, intra-pharyngeal anesthesia by the vapor method is used. This form of anesthesia is also ideal where the antrum or nasal fossa are opened. For any operation in which hemorrhage is profuse. Ether vapor is preferred. The packs in the mouth need to be changed so often that it is quite impossible to procure a smooth anesthesia using nitrous oxid.

A factor which must also be considered in a dental practice is the patient's preference for an anesthetic. When the operation can be performed equally successfully under local or general anesthesia the feelings of the patient may well be respected.

In conclusion, the point which the author has desired to emphasize is that local and general anesthetics have certain well defined fields for their administration and that certain operations can be better performed under one than the other. Only by employing the indicated anesthetic can we give our patients the best service and protection. The correct selection of the anesthetic is one of the chief factors in the successful operation.

## AN EXPLANATION FOR THE ANTAGONISTIC ACTION OF A SUBSTANCE SUCH AS CAFFEIN, TO THE ACTION OF GENERAL ANESTHETICS.\*

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URBANA, ILLS.

If one physiological process in the body is more important than another, oxidation is certainly the most important and, in fact, is so important that it is considered by some to be the life of the cell.

Stimulants as a rule increase oxidation, while depressants decrease it. Caffein, for example, increases the oxidative processes whereas the anesthetics decrease them.

We had already found that whatever increased oxidation in the body produced an increase in catalase, an enzyme possessing the property of liberating oxygen from hydrogen peroxide, by stimulating the alimentary glands, particularly the liver, to an increased output of this enzyme, and that whatever decreased oxidation produced a decrease in catalase by diminishing its output from the liver and by direct destruction.

The catalase determinations in the following experiments were made by adding 0.5 cc. of blood to

\*Read during the Seventh Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society, Hotel William Penn, Pittsburgh, Penna., October 5-7, 1920.



hydrogen peroxide in a bottle, and the amount of oxygen liberated in 10 minutes was taken as a measure of the catalase content of the 0.5 cc. of blood.

In Figure 1 it may be seen that the administration of 0.15 grams of caffeine per kilogram into the alimentary tract of a dog greatly increased the catalase of the blood with resulting increase in oxidation, while the anesthetics, ether, chloroform, and nitrous oxid, greatly decreased the catalase of the blood with resulting decrease in oxidation.

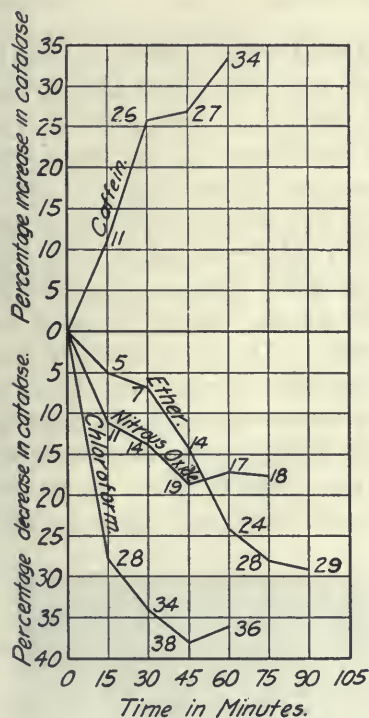


Fig. 1. Curves showing the Percentage Decrease Produced in the Catalase of the Blood by the anaesthetics, and the Percentage Increase Produced by Caffein.

The increase in oxidation with resulting stimulation produced by caffeine is attributed to the increase in catalase, and the decrease in oxidation with resulting anesthesia produced by the anesthetics is attributed to the decrease in catalase.

The antagonistic action of caffeine to the action of the anesthetics is attributed to the fact that the action of caffeine on catalase production is diametrically opposed to the action of the anesthetics, that is, caffeine produces an increase in catalase while the anesthetics decrease it.

## ADMINISTRATION OF CARBON DIOXID AFTER ANESTHESIA AND OPERATION.\*

STANLEY P. REIMANN, M.D., GEORGE H. BLOOM, M.D., AND HOBART A. REIMANN.

PHILADELPHIA, PENNA.

The administration of carbon dioxide after anesthesia has been urged on a number of occasions.<sup>1</sup> Its benefits have been considered both from the theoretical standpoint and from actual trial. From the theoretical standpoint, it might be remarked, before proceeding to a discussion, that considerably more factors than are ordinarily taken into account must be considered. From the actual practice of this procedure, it is claimed that recovery from the anesthetic is hastened by the augmentation of breathing, that it has a powerful stimulating effect on the circulation, particularly the venous return, and that it causes a rapid restoration of arterial pressure without subsequent relapse. It produces a decrease of postoperative nausea and thirst, and a possible restoration of intestinal tonus. The latter leads to a diminution or entire absence of gas pains.

These propositions, it is evident, are essentially matters of opinion. It is extremely difficult, if not

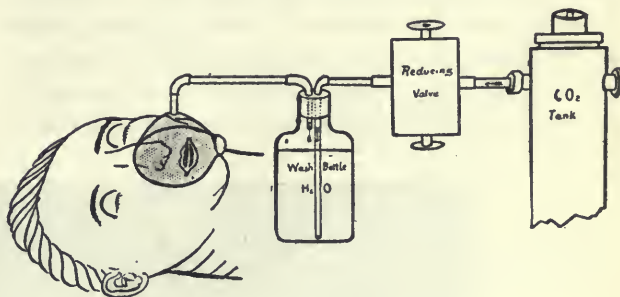


Fig. 1.—Apparatus for administering carbon dioxide.

impossible, definitely to compare differences in recovery time between anesthetized patients to whom carbon dioxide is given and those who are allowed to recover in the ordinary way. Possibly a statistical treatment of the results in a large number of carefully selected patients and controls would decide. The same thing is true of nausea, vomiting and gas pains. The benefits of this treatment are stated confidently, however, and it was decided to try the method in this hospital.

### METHOD OF ADMINISTRATION OF CARBON DIOXID.

The apparatus and technic used were the same as that described by Henderson, Haggard and Coburn.<sup>1</sup>

\*Read during the Seventh Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society and the Medical Society of the State of Pennsylvania, Hotel William Penn, Pittsburgh, Penna., October 5-7, 1920. Awarded one of the First Prizes of the N. A. R. S. for meritorious research. From the Department of Pathology of the Lankenau Hospital.



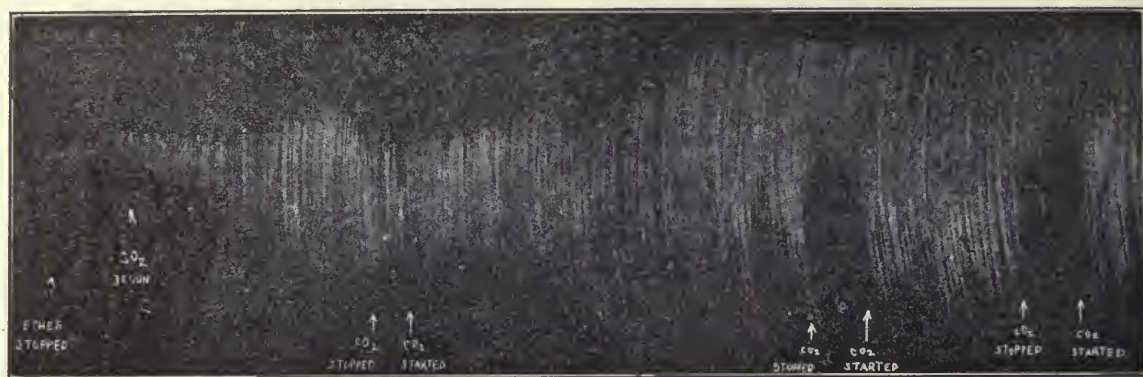


Fig. 2.—Increased respiratory activity.

The gas was obtained from a tank, and led through a reducing valve to a mask similar to those used on a nitrous oxid apparatus. The patient breathed in and out of a tube in the mask 2.5 cm. in diameter. A small glass tube, passed through another opening, led the carbon dioxid into the interior of the mask (Fig. 1). During inspiration the gas was mixed with air entering the large opening. During expiration it wasted with the expired air into surrounding atmosphere.

No account can be kept by this method of the exact quantity of carbon dioxid inspired, but a short experience enables the operator to judge, from the color and breathing, how firmly the mask should be pressed over the patient's mouth and nose. It is necessary, in order to secure effects, that the concentration of

were returned from the operating room in good condition, with good color, warm skin, and a respiratory rate fairly regular, of from 30 to 35 a minute. The ether was administered by the drop method. Carbon dioxid was given for one-half hour, and the interval between discontinuation of the anesthetic in the operating room and the start of the carbon dioxid varied from ten to twenty minutes. The first effect was observed very quickly—that of increased rate and depth of respiration. The color became rosier; the pulse rate was generally increased, but the peripheral blood pressure as measured by a Tycos instrument, showed no constant change. The administration was interrupted in many cases by efforts on the part of the patient to vomit, and toward the end of the half hour,

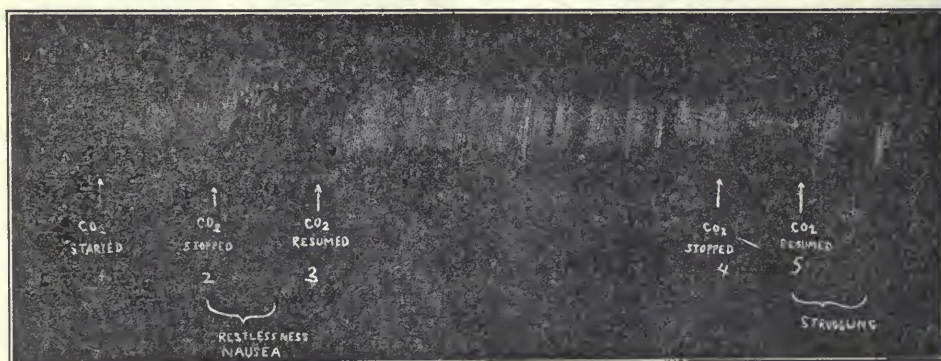


Fig. 3.—Increased respiratory activity.

carbon dioxid in the alveolar air be kept higher than normal. From 6 to 8 per cent. of the gas is recommended for inhalation. In actual operation, too much gas produces cyanosis; too little, no effect. By carefully allowing the patient's rate and depth of respiration to maintain a maximum, and at the same time observing that the color is good, it is easy to regulate the practical dose.

All the patients on whom the procedure was tried

by tossing of the head, and purposeful movements of the upper extremities directed toward pulling away the mask. Several patients who had received only a small quantity of ether recovered consciousness and announced this fact by asking for air, even though their color was good and their breathing had been no more violent than others. Graphic records of the respiratory excursions are shown in Figures 2 and 3. They were obtained by a spring stethograph



connected by air pressure to a tambour, the movements of which were recorded on a kymograph (Fig. 4).

## COMMENT

The further history of these patients with respect to nausea, vomiting and gas pains was carefully kept. On these points, it is necessary that an opinion be given. This represents our judgement and the opinions of the deaconesses in charge of the wards. The latter is valuable, in that it represents the experience of many years, in the handling of operative patients in active wards. In our combined opinion, therefore, the administration of carbon dioxide did not materially hasten the recovery from the anesthetic, doing very little toward preventing vomiting and gas pains. We are convinced that nothing short of mathematical methods will discover the differences, if any exist. It is obvious that its benefits in these directions are not clear.

From the theoretical standpoint, there is great interest in the discussion of this procedure. Carbon dioxide should be considered not merely as a waste product to be eliminated, but as a substance having

it is necessary to recall a few facts relative to the acid-base regulatory mechanism of the body. The hydrogen-ion concentration of the blood is kept, in health, at a remarkably constant figure. The acids yielding this constant hydrogen-ion concentration are of two varieties: volatile, namely, carbon dioxide, and fixed. They are derived from metabolic activities. The carbonic acid is excreted through the lungs, the fixed acid radicals mostly through the kidneys, and at such rates that the balance of the acid and alkali is always kept constant. If, for some metabolic reason, an excess of acid is produced, there is less room for carbonic acid, which can be quickly ventilated off and kept at the compensated level by increased respiratory activity. Analyses of the blood will show a diminished amount of carbon dioxide. If, on the other hand, a lower level of blood carbonic acid is brought about by overventilation, the blood becomes more alkaline, and under these circumstances it would be reasonable to administer an acid like carbon dioxide. But experiments of Macleod and Knapp<sup>3</sup> indicate that there is a compensatory mechanism for increased alkalinity. They found that there is an in-

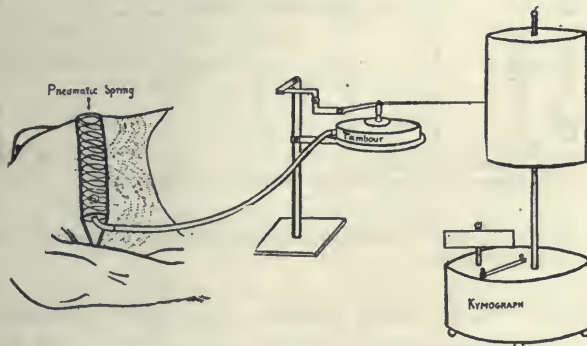


Fig. 4.—Method of obtaining graphic records of respiratory excursions.

properties of definite physiologic importance. There are two distinct opinions in reference to the effect of carbonic acid on the respiratory center. The one states that the normal stimulant of the respiratory center is the hydrogen-ion concentration of the blood; the other, that this factor plus a specific influence possessed by carbon dioxide is the respiratory hormone.<sup>2</sup>

In other words, carbonic acid is regarded by some as a mere acid, but a very convenient one, on account, for example, of its ease of excretion. By others it is regarded as an acid, with an additional stimulatory property.<sup>2</sup> Some of the following arguments in reference to the administration of carbon dioxide after anesthesia require that these points of view be remembered. In addition, before proceeding further,

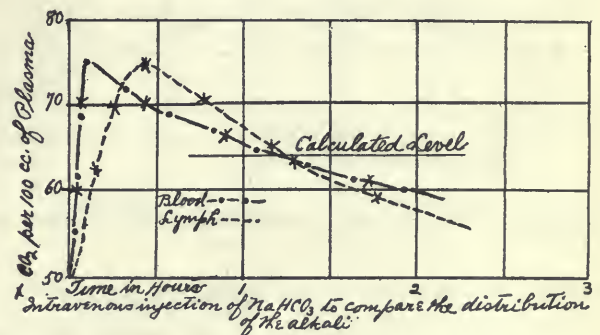


Fig. 5.—Intravenous injection of NaHCO<sub>3</sub> to compare the distribution of the alkali.

crease of lactic acid in the blood in experimental alkalosis. There therefore seems to be a mechanism which adds acid to the blood when this fluid becomes too alkaline.

The condition of diminished carbon dioxide, not due to the forcing out of this acid by another stronger one, has been termed "acapnia." The effects of this condition, among others, are a depression of the respiratory center, and a lowering of the hemoglobin dissociation curve. That is to say, less oxygen is liberated from a given volume of blood. The latter effect is very remarkable in its delicacy; a measurable change can be detected by a change in concentration of free carbonic acid of one part in one hundred million.<sup>4</sup> The depression of the respiratory center



is very small in alkalosis, contrary to the stimulating effects of even small amounts of acid. This is brought out graphically in the carbon dioxide diagram of Haggard and Henderson.<sup>5</sup> Acids, including carbonic acid, have the power of increasing the *availability* of oxygen in oxyhemoglobin. There is no specific action manifested by carbon dioxide in this respect, however.<sup>6</sup> It may be argued that with less oxygen available, there can be less carbon dioxide produced, and consequently, a vicious circle may be established. The possibility, however, must never be overlooked that in conditions in which free oxidation is hindered, partial oxidation products, acid in nature, may be produced. There is abundant evidence that there is interference with oxidation in anesthesia.<sup>7</sup> Indeed, one of the well known theories as to the way in which an anesthetic produces anesthesia hinges on depression of oxidation.<sup>8</sup> The other theory refers it to a diminution of the permeability of cell membranes,

tion: too much carbon dioxide is removed by the increased respiratory rate and depth during anesthesia. Our standpoint is that the reduction is due to the entrance into the blood of other stronger acids, which turn out the carbon dioxide. Henderson says that the blood is more alkaline; we say that the hydrogen-ion concentration remains the same in all but a few, in whom, if anything, it tends to rise. Shall we give carbon dioxide or not? If the carbon dioxide is blown off, the organism should compensate in a manner similar to that indicated in the experiments of Macleod and Knapp. If carbon dioxide owes its properties only to its acid nature, it should make no difference to the respiratory center whether the acid ions are offered to it from carbonic acid or any other acid.

In 1918, work indicated that acids of at least one kind, namely, the acetone-diacetic acid group, are increased in the blood.<sup>10</sup> The technic by which these results were obtained has been justly criticized by

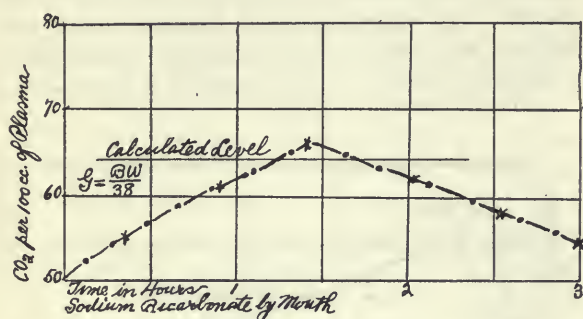


Fig. 6.—Charted result of sodium bicarbonate given by mouth.

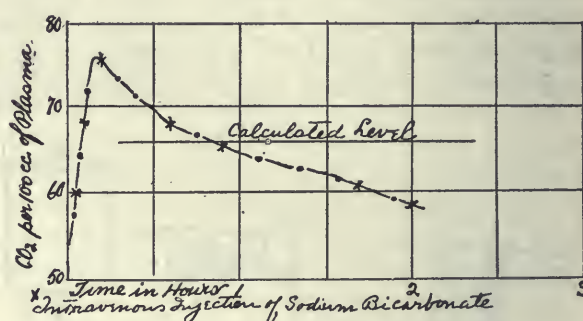


Fig. 7.—Charted result of sodium bicarbonate given by intravenous injection.

which may also lead to incomplete oxidation.<sup>9</sup>

To return to the question of the specific activities of carbon dioxide, the proposition is immediately presented: If the total acids of the blood are the respiratory stimulant and the factor which makes oxygen available from the oxyhemoglobin, why attach such importance to carbon dioxide as a mere acid? Since there is, however, still debate on whether carbon dioxide is more than an acid to the respiratory center, there is room for argument on the other side. The carbon dioxide diagram of Haggard and Henderson<sup>5</sup> is a most ingenious treatment of the subject. They reach the conclusion that the hydrogen-ion concentration of the blood is the important factor.

It remains to apply these arguments to anesthesia. The one definite fact acceptable to all observers is that the carbon dioxide carrying power of the blood is reduced by this procedure. It is the nature and the cause and the significance that are in doubt. Henderson says that the reduction is due to overventila-

Short,<sup>11</sup> who found, however, that these acids were increased, though later in the recovery time. He has also investigated the time interval, in two instances, of the well known ketone excretion in the urine. Neither blood nor urine increases corresponded to the maximum fall in the carbon dioxide of the plasma. The decreased permeability of cell membranes is to be considered a factor in this connection. The time element seems very important, but remembering that oxidation is hindered, and that one series of acids is increased, though later, it seems reasonable that other acids resulting from partial oxidation are also increased. Knowledge of the sum total of these, with their times, is necessary to close the subject.

An examination of experiments reported by Haggard and Henderson<sup>12</sup> shows that in an animal which has received an intravenous injection of hydrochloric acid in such amount that it would probably recover if left alone, the administration of carbon dioxide overstretching the compensatory power and the animal



dies. It seems most logical that in anesthesia the diminished carbon dioxide follows the formation of incompletely oxidized substances, acid in nature, and, therefore, the administration of another acid, namely, carbon dioxide, is contraindicated. Alkali should be given.

The diminution of the carbon dioxide carrying capacity of the plasma as a result of anesthesia and operation varies from 5 to 15 c.c. or more. In the majority of cases, this does not reduce the carbon dioxide to below the generally accepted danger point, namely, 50 c.c. per hundred c.c. of plasma. In about 15 to 20 per cent. it will fall below this figure. There are a number of conditions that will predispose to this. First, it may be emphasized that those patients who show lower levels of carbon dioxide before operation will show a greater diminution after operation. Impaired kidney function, duration of anesthesia, pre-operative preparation, i. e., starvation, partial or complete, for spreading peritonitis, hemorrhage, the

TABLE 1.—RESULT OF ADMINISTERING CARBON DIOXID

Blood Pressure			Plasma CO <sub>2</sub>			Gas
CO <sub>2</sub> Begun	15 Min. Ended	CO <sub>2</sub> Stopped	Before	When CO <sub>2</sub> Stopped	At End of Half Hour	
130	130	130	51.0	48.0	Did not answer to spoken word; marked vomiting at 23 min.	0
120	110	120	50.3	53.4	No vomiting; moving at 20 min.	+
110	100	100	48.6	48.6	No vomiting; moving at 20 min.	++
110	110	105	47.4	44.7	Attempted to vomit in 18 min.	++
130	120	124	56.0	50.4	Regain consciousness in 12 min.; asked for air is 30 min.	+
100	96	94	50.4	46.6	Restless and vomiting in 0 min.; noisy at 30 min.	0
105	108	108	45.7	45.7	Vomiting in 10 min.; noisy at 30 min.	0
105	105	105	43.1	44.1	No vomiting; moved at 30 min.	+

Plasma CO <sub>2</sub>			Dogs	
Ether Time	Before	When CO <sub>2</sub> Stopped	At End of Half Hour	
32	35.6	36.5	Dog under anesthetic; howling and moving in 14 min.; walked in one-half hour.	
30	39.0	35.3	Struggling in 18 min.	
22	37.3	35.3	CO <sub>2</sub> stopped and started 3 times to adjust kymograph; biting at 13 min.	
43	35.6	38.4	Reacted to stimuli in 5 min.; completely out in 30 min.	
64	39.3	32.8	Anesthesia light throughout; howling in 8 min.	

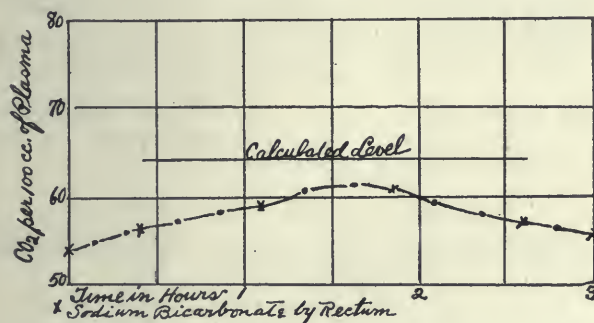
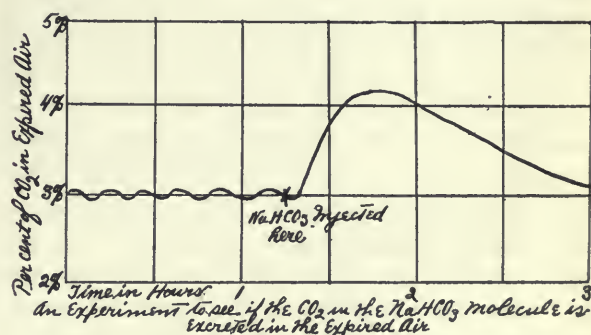


Fig. 8.—Charted result of sodium bicarbonate given by rectum.

Fig. 9.—An experiment to see if the CO<sub>2</sub> in the NaHCO<sub>3</sub> molecule is excreted in the expired air.

possibility of postoperative shock, are all factors tending to reduce carbon dioxide more than usual. The administration of an alkali is then indicated to supply base, both for neutralization of excess acids, and to carry the ordinary carbon dioxide produced in the tissues. For this purpose, sodium bicarbonate answers the requirements. It might be remarked that, in addition to its alkaline properties, it has carbon dioxide in its molecule. Administration of this substance definitely increases the carbon dioxide level of the blood. Our findings after the administration of carbon dioxide are shown in Table 1. It did not uniformly increase this substance in the plasma. In fact, the plasma fell in more instances than it rose. Controls are shown in Table 1. Their plasma all decreased in carbon dioxide. Blood was collected just before the administration of the gas was begun, and just before it was stopped. The same increase of

TABLE 2.—CONTROLS: NO CARBON DIOXID ADMINIS  
TERED

Patients				Dogs	
Blood CO <sub>2</sub>		Blood CO <sub>2</sub>		Blood CO <sub>2</sub>	
Before	After	Before	After	Before	After
56.0	52.3	56.0	56.0	49.0	43.0
54.1	52.3	48.3	44.2	39.2	31.2
51.4	48.6	51.2	48.6	46.1	43.2
53.2	51.4	49.1	46.3		

rate and depth of respiration was observed in animals but no particular decrease in their recovery time. In the patients, the blood pressure in the radial artery was variedly increased, diminished or stationary. The question, however, is not blood pressure so much as increased blood volume returning to the right heart. It is probable that the vigorous respiratory effort during the inhalation of carbon dioxide brings this about by its pumping action. The color of all the patients became perceptibly rosier.



To return to the administration of sodium bicarbonate: It is a simple matter to determine whether this is indicated. If, before operation, the plasma of a patient shows a carbon dioxid carrying capacity of 58 c.c. or less, it should be given. From the preceding discussion, it is clear that an overdose is to be avoided. If, on the other hand, too little is given, it will not accomplish its purpose. Through the use of the formula devised by Palmer and Van Slyke,<sup>13</sup> accuracy in the dosage can be easily obtained. It may be thus employed: An estimation of the plasma carbon dioxid is made before operation, and if it is desired to increase this, alkali may be administered an hour before operation. The dose is calculated from the formula  $G = \frac{BW}{38}$ , in which  $G$  is the dose in grams of bicarbonate to be given;  $B$ , the desired increase in plasma carbon dioxid, and  $W$  the patient's weight in kilograms. Given by mouth when good gastric emptying exists, the maximum height of blood carbon dioxid will be reached in about one and a half hours to two hours after administration. It will gradually fall and reach somewhere near the previous level in another similar time. Intravenously, the maximum is reached just after the injection ceases, and its effects decrease in the form of an exponential curve to the neighborhood of the starting point in about two hours. The duration as well as the maximum effect will vary with a number of factors, but can be gauged quite practically. The dose may be divided over a period of several hours, with a corresponding decrease in the maximum at any time, but a lengthening of the effective smaller increase. Administration by rectum also produces the increase of blood carbon dioxid, but, in our hands, short of the calculated one. Finally, if any doubt exists, another blood determination will answer the question.<sup>14</sup>

#### SUMMARY AND CONCLUSIONS

This review concerns the administration of carbon dioxid after anesthesia. In view of the experiments and results reported, and the consideration of its therapeutic and theoretical bases contrasted with the administration of an alkali, the use of sodium bicarbonate in a practical way is indicated.

Sodium bicarbonate should be given to selected surgical patients. The use of carbon dioxid by inhalation is contraindicated.

Since this article was written, Carter<sup>15</sup> has published results which strengthen our arguments very materially, and give a decided blow to the practice of giving carbon dioxid after anesthesia.

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#### AIR CONTROL AS A MEANS OF REDUCING THE POSTOPERATIVE DEATH RATE.\*

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It is a well established principle that the success of an operation depends upon the condition of the patient quite as much as upon the skill of the surgeon. Hence any condition which tones up the patient during the days of greatest stress is of high importance. The condition of the air appears to have this effect to a marked degree. To a certain extent this has always been recognized, but the full complexity and delicacy of the atmospheric reactions has rarely been perceived. The right temperature and absolute purity to which attention is commonly directed, are by no means enough. The right humidity and variability appear to be almost equally important. A study of postoperative deaths in the Massachusetts General Hospital for 10 years and in the Boston City Hospital for five seems to indicate that if the air were ideal in all these respects, the death rate might be largely reduced—perhaps as much as 20 per cent.

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society, William Penn Hotel, Pittsburgh, October 5-7, 1920. Awarded one of the second prizes by the N. A. R. S. for meritorious research.



## GENERAL CONSIDERATIONS.

Before studying the postoperative deaths in Boston it will be advantageous to summarize certain more general results. These indicate what are the best conditions—the optima—in temperature, humidity, and variability among people of all kinds both in health and in sickness. I shall refer chiefly to my own work because its statistical foundation is larger than that of earlier work. Having thus seen how human health and activity in general are influenced by the condition of the air, we shall look at one specific disease, lobar pneumonia, and then turn to our main objective—operations.

## EFFECTS OF TEMPERATURE ON HEALTH AND STRENGTH.

To begin with temperature, there is general agreement that under ordinary circumstances 68° F. is as high as the thermometer ought to run. Yet recently in one of our best hospitals, one of the few where systematic attention is paid to the air, I found that the temperature was above 70° about 80 per cent. of the time, including night as well as day, above 74° about 40 per cent. of the time, and actually above 80° with a maximum not lower than 86° in certain instances.

Even in Florida the best coordination of body and mind among three different sets of Cuban cigar makers occurred when the average temperature was only 64°, 65° or 68° respectively, that is, when the maximum rarely rose above 75°.

The major portion of Table I. is based on about nine million deaths in the cities of France, Italy, and all parts of the United States during a period of about 15 years. The mean monthly temperature in each case was compared with the departure of the death rate from the normal, each city being taken by itself and reckoned in percentages of its own normal. The unanimity of the figures is striking. Except in a few exceptional cases which are explained by epidemics, special conditions of wind, and so forth, the death rate is lowest when the temperature averages from 62° to 65°. From all these data, which are fully explained in the publications listed under the table, it appears that in climates as diverse as those of Maine and Florida, or Normandy and Sicily, man's health and strength are greatest when the average temperature is about 64° F. Under such circumstances the temperature at sunrise in most climates may be as low as 56° or 58°, while at noon for an hour or two it may

TABLE I. EFFECT OF TEMPERATURE ON HEALTH AND STRENGTH.

No. of Cases.	Nature of Criteria.	Best Temp.	Effect of 10° F. on Death Rate. Per Cent.
1. 781,000	Deaths, north Italy, 1899-1913 .....	58°	21
2. 300	Piece work, men, 2 Conn. factories, 1910-13 .....	59°	—
3. 200	Piece work, girls, 1 Conn. factory, 1911-13 .....	60°	—
4. 8,000	Deaths, British Columbia, 1914-16 .....	62°	25
5. 122,000	Deaths, Southeastern U. S., 1900-12 .....	62°	10
6. 9,000	Piece work, Pittsburgh, 1910-13 .....	63°	—
7. 752,000	Deaths, Southern Italy, 1899-1913 .....	63°	27
8. 380	Cuban cigar makers, Tampa, Fla., 1913 .....	64°	—
9. 838,000	Deaths, Southern France, 1901-10 .....	64°	17
10. 2,500,000	Deaths, Northeastern U. S., 1900-12 .....	64°	15
11. 921,000	Deaths, Whites, Eastern U. S., 1912-15 .....	64°	12
12. 71,000	Deaths, Dry Interior of U. S., 1900-12 .....	64°	15
13. 1,315,000	Deaths, Northern France, 1901-10 .....	65°	17
14. 739,000	Deaths, East Central U. S., 1901-10 .....	65°	18
15. 400	Cigar-makers, Cubans, Tampa, Fla., 1913 .....	65°	—
16. 167,000	Deaths, Negroes, Eastern U. S., 1912-15 .....	68°	12
17. 380	Cuban Cigar-makers, Tampa, Fla., 1912 .....	68°	—
18. 142,000	Deaths, California, 1900-12 .....	70°	18

N. B.—The data of this table are compiled from two volumes entitled *Civilization and Climate*, Yale University Press, 1915, and *World Power and Evolution*, Yale University Press, 1919, by Ellsworth Huntington. The table is taken from an article entitled *The Purpose and Methods of Air Control in Hospitals*. *Modern Hospital*, Vol. 14, 1920, April and May.

The temperature which is best for the human body is indicated in Table I. This table is based partly on a comparison between the amount of piece work done per hour and the mean temperature for the 24 hours. In Connecticut the fastest and most accurate work of 300 operatives for 4 years and of 200 for three years was done when the daily mean was about 60° F, which means that the noon temperature did not rise much above 65°.

rise to 70° or even 72°, but the range is more likely to be 60° to 68°. In dry climates the range may be from 50° to 80°, but that is extreme. When the average rises even a few degrees above 64° the death rate begins to increase rapidly. At lower temperatures the same is true, but not to so marked an extent. Since the facts here stated apply to workers who are in good health and also to sick people who are on the point of death, it would seem as if in



surgical cases the surgeon and nurse as well as the patient ought to be at their best when the temperature averages 64°.

#### RELATION OF HUMIDITY TO HEALTH.

The relation of humidity to health is not so well understood as is that of temperature. Nevertheless, the data given in Table II. seem to be fairly conclusive. Among the nine million deaths with which we are dealing in France, Italy, and the United States the lowest death rate occurred not merely when the average temperature was 64°, but when the average relative humidity was about 80 per cent. A decrease in humidity even at this ideal temperature, as I have shown in *World Power and Evolution*, is accompanied by an increased death rate. On the other hand, at higher temperatures the most healthful condition is found at a lower relative humidity, while at lower temperatures the deaths are fewest when the air is completely saturated so that the relative humidity is 100 per cent.

This does not mean that dampness is desirable. A sharp distinction must be drawn between the condensed vapor which gives a feeling of chill and the imperceptible uncondensed vapor which merely makes the air feel soft and fresh. Without entering into further details, it may be pointed out that the net result of the study of humidity is to show that the ideal air contains about 5 grains of water vapor per cubic foot of air. This amount of moisture gives a relative humidity of about 100 per cent. at 56°, and 76 per cent. at 64°, and 63 per cent. at 70°.

TABLE II. EFFECT OF HUMIDITY ON THE DEATH RATE.

A. Percentage of increase in the Death Rate, accompanying a Decrease of 10 per cent. in Relative Humidity at 40°F.

1. Northeastern U. S., 1900-12 .....	0.8
2. East Central U. S., 1900-12 .....	1.3
3. Dry Interior of U. S., 1900-12 .....	2.0
4. Large cities of U. S. Whites, non-contagious diseases 1912-15 .....	3.3
5. Large cities of U. S., Negroes, non-contagious diseases, 1912-15 .....	4.0
6. British Columbia, 1914-16 .....	7.0
7. Large cities of U. S. Whites, contagious diseases, 1912-15 .....	9.5
8. Southern France, 1901-10 .....	10.0
9. Northern France, 1901-10 .....	11.0
10. Northern Italy, 1899-1913 .....	12.5

B. Percentage of Increase in Death Rate, accompanying a Decrease of 10 per cent. in Relative Humidity at all temperatures from December to March, 1900-14:

11. Saint Louis .....	0.6
12. New York City .....	1.2
13. San Francisco .....	3.8
14. Baltimore .....	5.0
15. Chicago .....	7.8

N. B.—The data of this table are taken from the sources mentioned in the note to Table I and from an article entitled *The Interpretation of the Death Rate* by *Climographs*, Modern Medicine, Vol. I, 1919, pp. 13-22.

With humidity, as with temperature, the study of death, disease, and health indicates that a certain degree of latitude is not only allowable, but probably desirable. Thus no great harm appears to ensue if the vapor content of the air drops for a while to 3 grains per cubic foot or rises to 7 grains.

In view of the effect on health on the one hand, and the danger of condensation on walls and at night in winter, it appears that under ordinary conditions the aim should be a vapor content of 4 grains. This will give a relative humidity of about 60 per cent. at 64° and 50 per cent. at 70°; the wet bulb will stand at 56° in one case and 59° in the other; and the dew point, which determines the lowest level to which the temperature of the walls can be allowed to fall, will be 52°.

One other point deserves notice. Moist air feels warmer than dry. Of course if the air actually contains droplets of water, even though they are invisible, they make the skin moist and give a cool feeling because of evaporation. We are concerned, however, with true vapor. Everyone knows how warm the air in a greenhouse feels. Because it contains so much moisture the air of a greenhouse at 70° often feels uncomfortably warm. On the other hand, when the temperature is about 64° and the vapor content near 5 grains, the air has a delightful, springlike quality. It feels as warm as dry air at 70°, and yet has nothing of the enervating quality of the warmer greenhouse air which at that temperature may contain over 7 grains of vapor. It is exactly the sort of air needed in hospitals. In operating rooms a somewhat higher degree of moisture may be advisable, but we shall return to this later.

The view of atmospheric moisture here set forth is so unusual that it is sure to be questioned. The objector will point to health resorts in dry climates and to the undoubted benefit derived from a sojourn in such places. The answer is that the benefit comes from other conditions; namely, (1) the relief from routine duties and from anxieties which usually accompanies a journey to a health resort; (2) the outdoor life; (3) the excellent temperature during the winter when people usually go to such places. The real test of the effect of a dry climate is found in its influence on people who live there all the time. One line of evidence is the fact that outside of regions where tropical fever flourishes the highest death rates are usually found in dry regions. Cairo, Mexico City, Madrid, and the cities of Northern India are examples of cities where the death rate is



extraordinarily high in proportion to the latitude and temperature. More humid cities of similar type such as Havanna, Bombay, Calcutta, and Madris are much more healthful. If it be objected that the death rate varies from city to city because of sanitation, race, age of the population, and their non-climatic factors, we may compare the effect of the seasons in a place like Mexico City. There the temperature during the spring is almost ideal, averaging about  $60^{\circ}$  and rising gradually toward the optimum of  $65^{\circ}$ . Yet the death rate increases steadily and May with an average temperature of  $65^{\circ}$  is the worst month of the year. It is also the month when the relative humidity falls lowest. Then come the rains in June. At once the death rate declines, and falls off 13 per cent. in two months. The temperature is not the cause of this, for it drops to  $64^{\circ}$  in June and  $62^{\circ}$  in July, so that it is farther from the optimum in July than in May. The explanation seems to be either the increase in atmospheric moisture, or else the accompanying conditions such as cloudiness and freedom from dust. In India the beneficial effect of moisture in summer is equally marked. In fact, wherever I have been able to apply a fair test, I have been surprised to find how uniformly a pronounced lack of proper atmospheric conditions is reflected in poor conditions of health.

#### VARIABILITY OF TEMPERATURE AND HUMIDITY.

The third atmospheric condition which demands our attention is variability. A uniform temperature has long been the fetish of ventilation experts. There appears, however, to be no evidence in favor of it. Experiments on plants prove that they do not thrive best when the temperature is kept always at the optimum, but when it varies above and below that level. The difference between outdoor and indoor air is variability and movement even more than purity. The outdoor air varies not only from day to night, but with the passing of clouds, the movement of the sun, and with the constant variations in the strength of the breeze. Another evidence of the importance of variability is the striking correlation between the health of the various parts of the United States and Europe and the degree to which they are visited by storms which bring constant changes of weather. Variability in the temperature of the air almost always means movement, so that these two factors can scarcely be separated. In what follows I shall use the term variability but this must be interpreted as also including movement.

Far more conclusive evidence of the value of variability is found in a statistical study of deaths.

For a period of 8 years in New York City I have compared the change in the number of deaths from one day to the next with the change in the average temperature of the 24 hours. The results, as given in *World Power and Evolution*, were a great surprise. Systematically, at all seasons, winter as well as summer, a drop in temperature is correlated with a decline in the death rate, while a rise in temperature is accompanied by an increased death rate. The number of deaths, 400,000, and the length of the period, 2,920 days, are both too great to allow any possibility that this is the result of chance. Moreover, independent evidence such as the work of factory operatives, points to the same conclusion. Hence we seem forced to conclude that at all seasons a drop of temperature, unless it is too extreme, has a stimulating effect upon people who are at the point of death as well as upon those who are actively at work. This is quite independent of the fact that a continuance of low temperature is bad for the health. A rise of temperature, on the contrary, has a depressing effect. Nevertheless, when the two effects are combined, the benefit from a drop more than balances the bad effect of a rise. Thus for man, as for plants, variations of temperature seem to be beneficial.

The effect of variability needs further explanation. If the temperature is above  $64^{\circ}$  a drop clearly brings it toward the optimum, and the beneficial effect needs no explanation. Below  $64^{\circ}$  the effect of a drop appears to be like that of a mild cold bath. It starts the circulation and stimulates the whole body. It may be objected that a large part of mankind live indoors and hence feel little or no effect from outdoor changes. This is pre-eminently true of sick people, who are guarded most zealously. As a matter of fact, however, the outdoor influence penetrates far more than we realize. Most buildings are kept too hot. When the weather changes and a cold wave comes on, the first effect is for the houses to become cooler. The furnaces are almost always several hours behind the weather. This at once brings relief to the heart and presumably to the whole system. The New York State Ventilation Commission\* found that when sedentary persons are kept from morning till late afternoon in temperatures of  $68^{\circ}$  and  $75^{\circ}$ , respectively, the warmer room by the end of the afternoon imposes a strain of 23 heart beats per minute above the number needed in the cooler room. Yet even this is unsuccessful in preventing

\*G. T. Palmer: Role of Ventilation in Preventive Medicine; Modern Hospital, Vol. 1, 1919, pp. 509-515.



a rise of body temperature equivalent to  $1.5^{\circ}$  above what would have prevailed in a temperature of  $68^{\circ}$ . Part of this unfavorable result was probably due to extremely low humidity, and part to lack of variation in the air, as well as to the high temperature. The point for present emphasis, however, is that the drop in the indoor temperature which is the common result when a cold wave first comes, has an effect similar to the difference found by the Ventilation Commission between temperatures of  $75^{\circ}$  and  $68^{\circ}$ . The sick and the well both feel this, and apparently it stimulates them. In cold weather the stimulus seems to counteract the increased dryness which commonly accompanies a cold wave. Within half a day, however, the furnaces usually catch up, the indoor air is as hot as before and even drier, and the death rate again begins to rise.

The effect of a warm wave is apparent from what has just been said. In hot weather it taxes the heart and lungs and the whole body. On the other hand, when the temperature is below  $64^{\circ}$  the effect would be expected to be beneficial. The air not only approaches the optimum in temperature, but in humidity, for in cool weather a warm wave is usually the precursor of rain. Sometimes, to be sure, the air grows dry during a warm wave, and then we feel the debilitation of *spring fever*. The chief reason for the bad effect of warm waves during the cooler months, however is partly that people are likely to be dressed too warmly, but chiefly that the fires in nine buildings out of ten are not checked soon enough. An indoor temperature of  $75^{\circ}$  is very common when the air is growing warmer out of doors. The patient who has just passed through an operation is thereby forced to make 20 or 30 unnecessary heart beats per minute in order to prevent his high temperature from rising still higher, and even so the hot air may send his temperature up a degree or two. No wonder people die when the weather warms up even in winter.

Our system of heating turns what might be a blessing into a curse.

A concrete example will illustrate the relation of the temperature, water vapor and variability of the out-

TABLE III INDOOR AND OUTDOOR CONDITIONS AT TOPEKA, KANSAS, NOV. AND DEC., 1909

A Outdoor tempera- ture	B Number of cases	C Indoor tempera- ture	D Average indoor vap. content	E Average indoor relative humidity
$10^{\circ}$ or less	6	$72.7^{\circ}$	1.41	16.5
$11-20^{\circ}$	16	$74.0^{\circ}$	1.66	18.5
$21-30^{\circ}$	29	$74.0^{\circ}$	2.06	22.8
$31-40^{\circ}$	14	$73.1^{\circ}$	2.39	27.2
$41-50^{\circ}$	17	$72.8^{\circ}$	3.07	35.5
Over $50^{\circ}$	16	$72.3^{\circ}$	3.68	42.5

TABLE IV. TEMPERATURE COMPARED WITH CHANGE IN OUTDOOR TEMPERATURE DURING 24 HOURS, AT TOPEKA, KANS., NOV. AND DEC., 1909.

Change in outdoor temperature in 24 hours	Number of observa- tions.*	Average indoor temp.*	Average indoor va- por content
Drop of over $10^{\circ}$	14	$71.4^{\circ}$	1.94
Drop of $4-9^{\circ}$	10	$73.2^{\circ}$	2.48
Change of $3^{\circ}$ or less	20	$73.3^{\circ}$	2.58
Rise of $4-9^{\circ}$	23	$73.8^{\circ}$	2.49
Rise of over $10^{\circ}$	13	$74.0^{\circ}$	2.44

\*Owing to a clerical error these columns were printed wrongly in the Monthly Weather Review, Vol. 48, 1920, p. 506.

side air to the corresponding conditions within doors. In November and December, 1909, Mr. S. D. Flora of the United States Weather Bureau made a comparison of indoor and outdoor conditions on the basis of observations at 8 A. M., noon and 4 P. M., at the Weather Bureau office at Topeka, Kansas.\* From his data I have compiled Tables III and IV. Table III shows how the indoor conditions changed in response to the outdoor conditions. Except for a few unusually cold mornings, the indoor air was systematically warmer the lower the outside temperature. At best it averaged more than  $4^{\circ}$  above the proper limit, while 40 per cent. of the time it was about  $6^{\circ}$  above that limit, and  $10^{\circ}$  above the optimum as described above. Columns D and E show that most of the time the air was decidedly too dry, its vapor content averaging only about half the ideal, and the relative humidity being correspondingly low. Table IV shows how the indoor temperature is influenced by a change in the outdoor temperature. The greater the rise in outdoor temperature the higher the thermometer rises within doors. Considering the extra strain upon the heart as determined by the Ventilation Commission, it is not surprising that under the influence of a marked rise in temperature with an indoor temperature of  $74^{\circ}$  many more people die than with a drop and an indoor temperature of  $71^{\circ}$ . The humidity in this case has little to do with the matter, for it averages nearly the same in all parts of Table IV.

Tables III and IV are typical not only of office buildings all over the cooler parts of the United States, but of homes, schools, and hospitals. In all these places the air for about half the year is much too warm, too dry, and too uniform in temperature. During the rest of the year it is better, for the vapor content and variability are excellent in many parts of the country, but the temperature is still too high much of the time. And temperature is the most important of all climatic elements.

The principles set forth above appear to apply to people in all stages of health, although there are

\*Monthly Weather Review, May, 1917.



doubtless many modifications according to age, sex, physique, and type of ailment. The 7,200 deaths from lobar pneumonia which occurred in New York City during the year beginning April 1, 1917, illustrates this. Full details are given elsewhere\*, but the results are summarized in Table V. The first two lines show the number of days having a given mean temperature and a given degree of relative humidity. The next two indicate the actual amount of moisture in each cubic foot of air, while lines 5 and 6 give the relative humidity which the air would have had indoors if blown into a building in a stream of good volume at a temperature of 68°. If the air stagnates within doors it does not have quite so low a relative humidity as here shown because it takes some moisture from the breath and other sources. Line 7 gives the difference between the average temperature of the dry and moist days respectively. Except at the two extremes the two sets of days had practically the same temperature.

Lines 8 to 13 give the actual number of deaths and

the more general results already given. Lines 8, 9, 11 and 12 all show an almost steady decline in deaths as the weather grows warmer. A slight irregularity at a temperature of 33°-45° is due to a mild epidemic in the spring. The minimum death rate occurred when the temperature averaged 71°-75°. This may mean that the optimum temperature for pneumonia patients is a trifle higher than for people in general, or that the relatively small body of data here employed is not enough to give full certainty. The general principle of an optimum, however, with an increase in deaths at higher as well as lower temperatures is substantiated by the slight increase in deaths at the highest temperatures in all four lines. The effect of humidity is fully as distinct as that of temperature. Table V. gives 16 comparisons between days with low relative humidity and days of similar temperature with high relative humidity. In 15 of the 16 cases the more humid days have an advantage, and in the other case the two are alike. Columns E and F

TABLE V. RELATION OF LOBAR PNEUMONIA TO ATMOSPHERIC TEMPERATURE AND MOISTURE.

(7,200 deaths, New York City, April 1, 1917-March 31, 1918)

Section I. Conditions of the Atmosphere.

Mean Temperature	A 20° or less	B 21°-32°	C 33°-45°	D 46°-55°	E 56°-65°	F 66°-70°	G 71°-75°	H 76° or over
1. No. of days with Rel. Hum. below 65% (below 70%, E*-H)	16	31	38	38	21	16	21	15
2. No. of days with Rel. Hum. above 65% (above 70%, E-H)	14	17	34	33	30	15	17	11
3. Grains of water per cubic foot in drier group of days (1)	0.47	0.92	1.37	2.35	2.91	4.30	5.01	6.78
4. Grains of water per cubic foot in moister group of days (2)	0.55	1.38	2.06	2.98	4.36	5.97	6.85	7.70
5. Rel. Hum. of indoor air on drier days	6%	12%	18%	31%	39%	58%	57%	64%
6. Rel. Hum. of indoor air on moister days	7%	18%	28%	40%	58%	80%	78%	78%
7. Excess of Temperature on Dry days over Moist	3.2°	0.7°	0.8°	0.2°	0.6°	1.3°	0.3°	2.3°
Section II. Deaths per Day from Lobar Pneumonia on Same Day as Given Weather Conditions.								
8. Low Relative Humidity	27.5	26.5	28.2	22.4	20.3	10.6	6.7	6.8
9. High Relative Humidity	25.4	26.3	27.3	18.4	15.9	8.1	5.9	6.5
10. Advantage of Moist (9) over dry (8)	7.6%	0.8%	3.2%	17.8%	21.6%	23.6%	26.8%	4.4%
Section III. Deaths per Day from Lobar Pneumonia on Day After Given Weather Conditions.								
11. Low Relative Humidity	29.3	26.8	29.2	20.6	19.3	10.4	6.2	6.7
12. High Relative Humidity	27.2	25.5	28.6	19.2	14.3	8.2	6.2	6.5
13. Advantage of Moist (12) over Dry (11)	7.2%	4.9%	2.1%	6.8%	25.9%	21.2%	0.0%	3.0%
Section IV. Average of Sections II. and III.								
14. Advantage of Moist over Dry	7.4%	2.9%	2.7%	12.2%	23.8%	22.4%	13.4%	3.7%

the advantage of the moister over the drier days. The figures show that the effect of the weather is felt not only on the day in question, but also to an almost equal extent on the succeeding day. Finally, line 14 is the average of lines 10 and 13, and serves to sum up the percentage by which the moister days have an advantage over the dry.

RESPONSE OF LOBAR PNEUMONIA TO TEMPERATURE AND HUMIDITY.

Table V. shows that lobar pneumonia responds to temperature and humidity almost in accord with

are the most significant, for they represent the temperatures of 56°-70° at which our houses are kept or ought to be kept most of the year. In line 14 it appears that at these temperatures an additional grain and a half of moisture is accompanied by a drop of 20 to 25 per cent. in the death rate. This bit of evidence supports various others in indicating that for respiratory diseases a dry climate is worse than a moist one. The contrary belief has become traditional largely because in dry climates people live out of doors where their ancestors lived till a few centuries ago, and outdoors is always more healthful than indoors.

\*Ellsworth Huntington: The Control of Pneumonia and Influenza by the Weather. *Ecology*, Vol. 1, pp. 6-23, 1920.



## RELATION BETWEEN LOBAR PNEUMONIA AND VARIABILITY OF TEMPERATURE.

Our next step is to examine the relation between pneumonia and variability of temperature. This is shown in Table VI where the change in the number of deaths from one day to another is correlated with the change in mean temperature. In both the warmer and the colder halves of the year the figures display remarkable regularity. A marked rise of temperature is favorable, since there is a decline in the death rate; stationary temperature or only slight changes is unfavorable, since the figures are plus; and a decided drop of temperature is again favorable. Averaging the two halves of the year together, and also taking account of the effect of the smaller changes indicated by B and D, the days with a drop of temperature have a distinct advantage over those with a rise. At first sight the favorable showing of days with a rise of temperature appears to contradict our conclusion derived from 400,000 deaths to the effect that a rise of temperature is unfavorable. This seeming contradiction may mean that lobar pneumonia patients are favored by warm weather more than are people in general, an idea to which we have already been led by the data as to pneumonia and temperature. It may also mean that patients suffering from pneumonia are carefully guarded from becoming too hot. However this may be, it seems clear that although pneumonia has relation to temperature, humidity, and variability is essentially the same as that of the human organism in general.

## APPLICATION TO SURGICAL CASES.

This brings us to the final question: Are surgical cases sufficiently influenced by the condition of the air to make it worth while to modify our practice? An answer is found in the study of the postoperative deaths at the Massachusetts General Hospital from 1906 to 1915 and at the Boston City Hospital from 1914 to 1918. The answer is only partial, for the number of deaths—about 2,300—did not seem sufficient to warrant subdivision into the various types of operations. Therefore all postoperative deaths were included with the exception of (1) obstetric cases, (2) traumatic cases, and (3) cases where a second operation was performed. They were first compared with the conditions on the morning of the operation. A distinct relation of the three-fold type already described was plainly evident. When comparison was made with the weather on the morning after the operation used, however, the relation between the operation on the one hand and the temperature, humidity, and variability on the other, became still clearer. This is natural, for the critical time is after, not before the operation. Hence, unless otherwise stated, the weather conditions referred to below are those at 8 a. m. on the morning after the operation.

Only the main results are given here in Table VII, since the details have been published elsewhere.\* The numbers in the body of the table show the average number of deaths per day at both hospitals under the various weather conditions.

\*Ellsworth Huntington: Air Control and the Death Rate after Operations. *The Modern Hospital*, Vol. 14, pp. 10-15 and 111-114, 1920.

TABLE VI. EFFECT OF VARIABILITY OF TEMPERATURE ON DEATHS FROM LOBAR PNEUMONIA IN NEW YORK CITY, APRIL, 1917-MARCH, 1918.

Note the figures labelled "Change in deaths" indicate the average amount by which the number of deaths increased or decreased on the days having the indicated changes of mean temperature. The change in mean temperature is the amount by which the average of a given 24 hours is above or below the average for the preceding 24 hours.

	April to September.		October to March.	
	No. of Days.	Change in Deaths.	No. of Days.	Change in Deaths.
A. Rise of 6° or more .....	15	-1.60	43	-0.40
B. Rise of 2°-5° .....	54	0.61	44	1.07
..... 50 C. Change of 1° or less ....		0.04	25	1.32
D. Drop of 2°-5° .....	43	0.28	28	1.07
E. Drop of 6° or more .....	20	-1.55	42	-1.64

TABLE VII. RELATION OF THE WEATHER TO DEATHS IN POSTOPERATIVE CASES AT BOSTON HOSPITALS.

Tem. 8 A. M. Day After Operation.	No. of Days.	No. of Deaths.	Deaths Per Day.	60% A	Humidity 8 A. M. Day After Operation. Under	Advantage of Column D over Average for Given Temp.
					B 61-80%	C 81-100%
Over 70°	552	218	0.396	0.413	0.316	0.561
61°-70°	1087	423	0.393	0.415	0.391	0.381
51°-60°	934	357	0.383	0.460	0.395	0.334
41°-50°	873	396	0.453	0.503	0.440	0.444
31°-40°	986	435	0.422	0.531	0.424	0.407
30° or less	942	437	0.465	0.491	0.458	0.456
Weighted Average .....						
						D 91-100%
						0.775 (0.237)
						40.0%
						12.0%
						29.2%
						8.4%
						9.3%
						13.6%
						16.8%



The column marked "deaths per day" shows the effect of temperature. The smallest number of deaths, 0.383 per day, occurred when the temperature on the morning after the operation was between 51° and 60°. This includes most of the days having an average temperature of 64°, the rest falling in the group 61°-70°, which has the next lowest number of deaths. At high temperatures the deaths are not so numerous as might be expected, but this is probably because physicians have learned not to operate in hot weather unless it is absolutely necessary. In colder weather the number of deaths increases, being 21 per cent. more when the temperature is below 30° than when it is between 51° and 60°. If only the operations performed just previous to a morning temperature of 10° are considered, this figure rises to 31 per cent., for the average daily deaths are 0.500.

In estimating the importance of the preceding figures it should be noted that the effect of the seasons plays a prominent part. Because of the general condition of good health in the late spring and fall fewer surgical cases come to the hospitals. Hence the effect of the weather in the column marked "deaths per day" has in many cases been antecedent to the operation. On the other hand, if we take only the deaths in severe winter weather, we find an average of 0.458 for the 277 days with a temperature of 11°-20° in the morning and 0.500 for the 116 days when the thermometer was below 10°. This is not a seasonal effect, for the two sets of days are intimately mingled. At first sight it appears to be strictly an effect of temperature. More likely, however, it is only indirectly due to temperature, for patients who are about to undergo operations or have just undergone them are very carefully guarded. This strengthens a great many other lines of evidence in indicating that the humidity is a factor of great importance. Air at 10° can hold only 0.78 grains of vapor even when saturated.

In studying humidity we are not hampered by any confusion between the effect of the seasons and the direct effects of water vapor. This is evident in lines A, B and C of Table V. Here we have three degrees of humidity at each temperature level. Leaving for later consideration the days with a morning temperature above 70°, we find that in every other group with one slight exception, the number of deaths diminishes as the humidity increases. This becomes still more marked if we take only the most humid days with a relative humidity of over 90 per cent., as is done in column D. When column D is compared with the *average* for the re-

spective temperatures, it is found in every case to have a decided advantage ranging from 8 to 29 per cent. In other words, the percentages in column D represent the amount by which the postoperative death rate would apparently have been reduced if the humidity on the morning following the operation, which means in reality the humidity during the entire period directly after the operation, had been as favorable as it was on the most humid days. The largest percentage of improvement, 29.2, comes at the best temperature, 51°-60°. Only at that temperature does the air become warm enough to contain about 5 grains of moisture per cubic foot. The inference seems warranted that if the humidity were increased sufficiently at lower temperatures they would show an improvement even greater than at the more favorable temperatures, for even with a high relative humidity out-of-doors, the indoor humidity is low. Thus the weighted average of improvement at all temperatures might rise as high as 20 per cent. instead of 16.8 as given in Table V.

The true relation of humidity to health is perhaps best shown by the data contained in Table VIII for days when the temperature at 8 a. m. the morning after the operation was above 70°. On very dry days when the relative humidity fell below 40 per cent. and when the vapor content of the atmosphere fell below 3 grains per cubic foot the death rate was extremely high, 0.937. With increasing vapor it rapidly diminished until with a relative humidity of 51-60 per cent. and a vapor content of about 5 to 5.5 grains it was only 0.238. Then, with increasing moisture it rises steadily until on the most humid days with a vapor content of about 9 grains it is 0.775. These figures are particularly instructive because the elements of season and temperature are almost completely eliminated. Although there were 34 days when the thermometer at 8 a. m. stood above 80°, none of these days fall, in either the driest or the most humid groups of Table VIII, and only 2 in the group having a humidity of 41-50 per cent. and 1 in the group having 81-90 per cent. Thus the extreme death rates of these four groups cannot be due to high temperature. The only reasonable alternative seems to be that they were due to excessive dryness in one case and excessive moisture in the other. According to the methods of correlation used by Pearson and other students of such matters, we may consider a humidity of 5.4 grains as our reference point, the corresponding reference point for deaths being 0.238 per day. Then the correlation coefficient between the



departures of the moisture and of the deaths from the reference points is 10.90. Since this is 17 times the probable error, it means that mathematically it is a practical certainty that the changes in moisture or something which goes with those changes is the cause of the variations in the death rate.

TABLE VIII. DAILY DEATHS IN BOSTON HOSPITALS AFTER OPERATIONS PERFORMED IN WEATHER WHEN THE TEMPERATURE AT 8 A. M. THE NEXT MORNING WAS ABOVE 70°:

Relative Humidity	Approximate Vapor content	No. of Days	No. of Deaths	Deaths PerDay
Under 40 per cent.	2.8 grains	16	15	0.937
41-50 "	4.2 "	47	24	0.512
51-60 "	5.4 "	97	23	0.238
61-70 "	6.5 "	133	35	0.264
71-80 "	7.5 "	129	48	0.372
81-90 "	8.2 "	99	49	0.495
91-100 "	8.9 "	31	24	0.775

As a final summary of the effect of atmospheric moisture on the postoperative death rate it is worth while to study Table IX. Here all the days have been grouped according to the vapor content of the atmosphere without regard to temperature, relative humidity, or season. There are some irregularities due to the fact that 2,300 deaths is a comparatively small number. Nevertheless, there is clearly a steady decrease in the death rate with an increase in the vapor content of the atmosphere up to about 5 grains. Then the rate remains low, although somewhat erratic, up to 7 grains, after which it jumps rapidly. Taking 5.5 grains of water per cubic foot of air as the optimum, the correlation coefficient between the departure of the vapor content from the optimum and the deaths per day is 40.65 or more than 6 times the probable error. A close relationship is thus mathematically demonstrated. Temperature and other seasonal conditions, however, enter into this correlation, for the vapor content of the atmosphere varies roughly with the temperature. Nevertheless, the variations shown in Table IX seem to be due to vapor even more than to temperature. The reasons for thinking this are as follows: (1) The corresponding temperature figures as given in Table VII under the heading "deaths per day" do not show such great differences as are found in Table IX. In Table VII the maximum difference is 21 per cent. between temperatures of 51°-60° and 30° or less, or 31 per cent. if we take the group of 116 days having a temperature of less than 10°. In Table VII the group having a vapor content of 7.6-9.5 exceeds the 5.1-5.5 group by 70 per cent., while the 0.0-0.5 group exceeds the same best group by 50 per cent. We might use the 6.1-6.5 group and obtain

a still greater contrast, but it seems better to be on the safe side.

TABLE IX. DAILY POST-OPERATIVE DEATHS IN BOSTON HOSPITALS COMPARED WITH THE VAPOR CONTENT OF THE ATMOSPHERE AT 8 A. M. OF THE DAY AFTER OPERATION.

Vapor Content in Grains per Cubic Foot	Number of Days.	Number of Deaths.	Deaths Per Day.
0.0-0.5	258	130	0.504
0.6-1.0	467	211	0.452
1.1-1.5	721	326	0.451
1.6-2.0	453	212	0.468
2.1-2.5	654	280	0.428
2.6-3.0	358	165	0.461
3.1-3.5	354	150	0.424
3.6-4.0	341	139	0.408
4.1-4.5	228	96	0.421
4.6-5.0	414	143	0.346
5.1-5.5	302	101	0.335
5.6-6.0	227	93	0.410
6.1-6.5	317	100	0.315
6.6-7.5	133	43	0.323
7.6-9.5	138	79	0.571

(2) Surgical patients are largely protected from the effect of low temperature. In most cases they have been sick some time before the operation, so that they have been carefully sheltered from low temperature and of course after the operation they are in a warm—a too warm—hospital. Undoubtedly the patients are much harmed by the high temperature of the hospitals, but this effect is largely eliminated in Table IX. No matter what the vapor content of the air, the temperature in which the patients are kept averages almost the same for the whole of Table IX except that when the vapor content is from 5 to 7 grains, the air is variable because the windows are open. On the other hand, even in the best hospitals the patients have no protection whatever from improper conditions of humidity. In fact their protection from low temperature aggravates the evils of too little vapor. Moreover, the failure to protect the patients from high temperature in summer allows them to suffer from great humidity as well as from a deficiency. How harmful this is appears from the fact, already stated, that the hottest days in Boston are not included in the last line of Table IX. Hence in the 138 days of that line it chiefly was the excessive humidity which raised the death rate to 0.571, just as in the first line it was largely the lack of humidity which caused those 258 days to have a death rate of 0.504. This does not mean for a moment that there is any question that temperature is the most important of all atmospheric conditions, but merely that in our present practise we eliminate the effects of temperature far more completely than those of atmospheric moisture.

(To be continued)



# American Journal of Surgery

## QUARTERLY SUPPLEMENT of ANESTHESIA and ANALGESIA

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JULY EDITORIAL 1921

### A BUST OF MORTON FOR THE HALL OF FAME.

In the election of Dr. Wm. T. G. Morton to the Hall of Fame the allied professions of medicine and dentistry have been singularly honored. By their overwhelming vote the electors have also evidenced the appreciation of the public at large for the beneficence of anesthesia.

At the Annual Dinner of the American Anesthetists Dr. S. Adolphus Knopf, said it would be a proud privilege for the Associated Anesthetists to place a bronze bust of Morton in the niche assigned him by the electors. This is to be done in celebration of the Diamond Jubilee Anniversary of Morton's Demonstration of Ether Anesthesia.

The Associated Anesthetists, as well as other prominent leaders of the allied professions, are therefore, urging all those interested to make a substantial contribution for this purpose. Any surplus will be used to establish a fund for Research in Anesthesia.

Send your check or money order at once to

F. H. McMECHAN, M.D., Secy-Treas.,

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### ANESTHESIA SINGULARLY HONORED.

The greatest honor and distinction recently paid the specialty of anesthesia and the specialists in anesthesia has been the visit of Dr. H. Edmund G. Boyle, O.B.E., M.R.C.S., of London, England, as Official Representative of the Royal Society of Medicine to the Joint Meeting of the Canadian, Interstate and New York Anesthetists with the Ontario Medical Association at Niagara Falls, and to the Joint Meeting of the American Anesthetists with the American Medical Association at Boston.

Dr. Boyle is Anesthetist to and Lecturer on Anesthesia at St. Bartholomew's Hospital, London. He proved to be not only a very splendid and delightful type of the English gentleman, but also a very worthy descendant in that long line of pre-eminent anesthetists founded by John Snow.

The most important message which Dr. Boyle brought to the several meetings was that about the new anesthetic ethanesal, recently developed by one of his associates at St. Bartholomews, Dr. R. L. Mackenzie Wallis, a noted chemist of London. During the war Dr. Wallis was in service in India and his efforts to provide the medical service with a purified and improved ether resulted in the development of ethanesal.

According to Dr. Boyle, ethanesal is a compound of ketones in which carbon dioxide, ethylene and other gases are united. This ketone complex is dissolved in pure ether to the extent of from 2 to 5 per cent. The purification of the ether is a necessary preliminary and this is carried out in two stages, (1) Oxidation of aldehydes and mercaptans by finely divided permanganate. (2) Removal of acids, peroxides and water by means of anhydrous copper sulphate.

By distillation in a special reflux condenser a remarkably pure ether is obtained. This purified product with a constant boiling point possesses peculiar properties: (1) It is not anesthetic except in very large quantities. (2) It is a cerebral excitant and persons working with it get hilariously drunk.

To this pure ether the ketone is added and at once its properties are changed: (1) It becomes a safe and reliable anesthetic. (2) Its action on the circulatory system lies between that of chloroform and ether. (3) All the irritating effects usually observed with ordinary anesthetic ethers are now lost. (4) Analgesia can be maintained for a prolonged period. (5) Ethanesal is practically non-toxic. Large doses given to animals do not kill them. Rabbits, after having been anesthetized for several hours, have to be pithed in order to kill them. Children have been



given repeated anesthetics with ethanesal with no harmful effects. (6) It does not produce either glycosuria or ketosis and does not aggravate these conditions when present. (7) In animals it is without effect on blood pressure or respiration.

The ketone complex is the agent responsible for all the anesthetic action and is non-toxic in the amount used in the anesthetic ethanesal. This pure compound ketone has been isolated and belongs to the middle of the series of ketones. Many hypnotics and analgesics owe their specific action to the ketones they contain.

In finding this ketone complex in good ordinary anesthetic ether, removing the impurities in the later, which cause all the irritating effects, and putting back the anesthetic compound, it would appear that a new paragraph in anesthesia has been opened up. Ketones are not easily oxidized and so remain even in very bad samples or ordinary anesthetic ether and still exert an anesthetic action, although this is accompanied by all the usual irritating effects.

Some of the higher grades of anesthetic ether have very little anesthetic action because of the deficiency of the ketone complex. The possibilities of the new compound seem unlimited. If the ketone complex is used in a proportion above 5 per cent. anesthesia is very deep and consciousness is only slowly regained.

No unpleasant taste or smell follows its administration and the material itself is practically odorless, tasteless and non-toxic. Hence its value for children and old people and also in acute cases.

Further experiments are being conducted to eliminate entirely the necessity of using ether as a vehicle and to substitute an entirely innocuous volatile vehicle instead.

Dr. Boyle is also known in London as one of the pioneers in introducing and popularizing nitrous oxid-oxygen anesthesia. He used this with great success and infinite satisfaction to patients at the First London War Hospital and at Queen Alexandra's Hospital for Officers at Highgate. On the service of Sir H. B. Patterson, Dr. Boyle was able to practically eliminate post-operative pneumonias by this method of anesthesia and they were among the most serious complications of war surgery.

Dr. Boyle presented his views on and his experiences with nitrous oxid-oxygen anesthesia and its combinations to the Canadian, New York and Interstate Anesthetists, as well as to the Nose and Throat Section of the Ontario Medical Association and also before the overflow meeting of the Anesthesia Ses-

sion of Miscellaneous Topics of the American Medical Association.

During the Annual Dinner of the American Anesthetists as well as during the banquet of the Ontario Medical Association, Dr. Boyle took occasion to express his surprise that non-medical persons were still used to give anesthetics, and he denounced the exploitation of nurses giving anesthetics as "sweated labor." The use of nursing anesthesia had come up for consideration after the war in England, but all concerned with public welfare had decided that no person should administer an anesthetic not qualified to practice medicine and surgery.

Dr. Boyle was also a guest at the dinner of the American Medical Editors Association in Boston, and in his after-dinner talk he made a stirring plea to the editors present for support in the medical and dental press in behalf of the advancement of the science, practice and organization of anesthesia as a specialty. He also urged the medical and dental schools to give far more attention than heretofore to their courses in anesthesia. He alluded to the fact that the Royal Society of Medicine, whose Official Representative he was, had recognized anesthesia as a Section and he expressed the hope that the American Medical Association would presently take similar steps.

Dr. Boyle was accompanied by his charming wife and during their visit they were house guests of friends and anesthetists in New York City, Long Island, Rochester, Toronto, and Montreal.

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#### ORGANIZATION OF THE MID-WESTERN ASSOCIATION OF ANESTHETISTS, KANSAS CITY, OCTOBER 24, 28.

The Anesthetists of the Middle West will hold an Organization Meeting in Kansas City, Mo., October 24-28, in conjunction with the meetings of the Medical Veterans of the World War, Missouri Valley Medical Association, Medical Society of the Southwest and the National Anesthesia Research Society.

A splendid scientific program of pertinent papers is in the making for this occasion and the clinics to be held will offer every opportunity to see and demonstrate the latest methods of anesthesia.

Membership in the Mid-Western Association of Anesthetists is open to all licensed and qualified members of the medical and dental professions as well as to research workers holding doctorates of similar standing, who are interested in advancing the science and practice of anesthesia.



A Special Session will be devoted to Anesthesia for Oral Surgery and Dentistry.

Headquarters will be at the Hotel Muehlebach and the Scientific Sessions and Annual Dinner will also be held there. As a large attendance is expected at this Joint Meeting make your hotel reservations now.

If you wish to present a paper during the meeting kindly notify the Organization Secretary at once, giving the title and brief abstract of same.

Apply for and fill in the details of the Membership Application and return it with your check or money order for the annual dues (\$5) so that your Charter Membership Card may be sent you. Also send in the names and addresses of as many prospects for membership as you may know of.

The visiting ladies will be delightfully entertained so let the Secretary know how many will be in your party.

The following are the officers and Executive Committee for the Organization Meeting: R. M. Waters, Sioux City, Ia., President; David E. Hoag, Pueblo, and Nettie Klien, Texarkana, Vice-Presidents; Morris H. Clark, Kansas City, Secretary-Treasurer; F. M. McMechan, Avon Lake, O., Organization Secretary, and Members of the Executive Committee B. H. Harms, Omaha; J. E. Craig, Kansas City; R. S. Adams, San Antonio; R. L. Charles, Denver; E. M. Moorehouse, Yankton, S. D.; and A. E. Guedel, Minneapolis.

The Organization Officers and Executive Committee will do everything they can to make this meeting interesting, instructive and enjoyable and your cordial co-operation and support are solicited in launching the Mid-Western Association of Anesthetists on a successful career for the benefit of all concerned.

For further information, address

Yours fraternally and cordially,

F. H. McMECHAN, M.D.,

Organization Secretary,

Lake Shore Road, Avon Lake, O.

## Book Review

**The Art of Anesthesia.** By PALUEL J. FLAGG, M.D., Lecturer in Anesthesia, College of Physicians and Surgeons, New York City. *Second Edition Revised.* Pages 367; 136 illustrations. J. B. LIPPINCOTT Co., Publishers, Philadelphia and London.

Flagg and his Publishers are to be congratulated on the *Second Edition* of *The Art of Anesthesia* as an indication, not only of its merits, but of a very cordial reception by anesthetists as well as by the profession. The original purpose of Flagg's volume "as a groundwork upon which the student, interne and general practitioner may acquire a more

comprehensive knowledge of the Art of Anesthesia" has been strictly adhered to in this, the *Second Edition*. By repeated lectures to army officers and other medical men, Flagg has crystallized the ideas of inhalation and insufflation anesthesia. The former method has been developed with a view to the need of the medical man who must improvise his apparatus, the worker in the field hospital, casualty clearing station and autochir; the latter is recommended for the officer at work in the fully equipped base hospital.

A chapter on the choice of the anesthetic and the method of administration has been added as a résumé of the preceding chapters. Military anesthesia, in Flagg's estimation, resembles anesthesia of emergency in civil practice and if the difficulties of emergency anesthesia and operation are recognized and met, the well-trained anesthetist in civil life will not fail to render his country a great service when called to the battle line.

Flagg's volume remains one of the most useful for those who are teaching anesthesia; while those who practice and have mastered Flagg's fundamentals and the details of his Art of Anesthesia cannot but be successful anesthetists.

## Society Proceedings

### JOINT MEETING OF THE CANADIAN, INTER-STATE AND NEW YORK ANESTHETISTS.

The Canadian, Interstate and New York Anesthetists met with the Ontario Medical Association at The Clifton, Niagara Falls, Canada, June 1-3, 1921.

Dr. Samuel Johnson, Toronto, President of the Canadian and Interstate Anesthetists, and Dr. John J. Buettner, Syracuse, N. Y., President of the New York Anesthetists, presided.

During the preliminary executive session the minutes of the previous Interstate meeting and the report of the Secretary-Treasurer were accepted as read.

The following members of the allied professions were elected to Interstate membership: Dr. T. D. Archibald, Toronto, E. Roy Bier, Winnipeg; John C. Blezaed, Edmonton; Edgar S. Braunlin, Dayton, O.; W. Eason Brown, Toronto; E. R. Brubaker, Springfield, O.; T. Craig Burns, Buffalo; E. Leslie Burwell, New Rochelle; Arthur M. Dodge, Boston; W. P. Earngey, Rockford, Ill.; Beatrice Todd Hagen, Zanesville, O.; Aram E. Hancy, Portland, Maine; Ralph R. Harris, Columbus, O.; Henson M. Hazelton, Lancaster, O.; Harvey P. Hoffman, Buffalo; Wm. B. Howell, Montreal; Charles W. Hyde, Washington, D. C.; Curtis N. Jameson, Rochester, N. Y.; Charles J. Love, Lorain, O.; Mary Lyons, Chicago; A. W. McCally, Dayton, O.; C. W. Metz, Denver; H. H. Miltmore, St. Johnsbury, Vt.; Maxwell Quackenbos, Nyack, N. Y.; K. Lowder Reid, Atlanta; K. F. Roehrig, Denver; J. A. Saunders, Clifton Springs, N. Y.; W. S. Sykes, Cleveland; Lincoln F. Sise, Boston; Wm. L. Soule, Brooklyn; Wm. F. Temple, Jr., Boston; O. N. Warner, Washington, D. C.; Wm. Webster, Winnipeg; and Dana O. Weeks, Marion, O.

The following officers were elected for the 1922 meeting: Drs. A. E. Guedel, Indianapolis, Chairman; W. T. Shannon, Detroit, Vice-Chairman; F. H. McMechan, Avon Lake, O., Secretary-Treasurer; Members of Executive Committee, Lamora Shuey, Toledo; S. Griffith Davis, Baltimore; J. Wade Elphinstone, Pittsburgh; O. C. Hickman, Denver; Robert E. Jameson, Davenport, Ia.; and Charles N. Combs, Terre Haute, Ind.

After receiving the gavel Dr. Samuel Johnston welcomed the anesthetists in behalf of the Canadian Societies.

During the first Scientific Session the following papers were presented:—

Anesthesia—Its Place in the Practice of Medicine. (President's Address, New York Anesthetists) John J. Buettner, M.D., Syracuse, N. Y.

Charting the Signs and Symptoms of Anesthesia for Teaching Purposes, A. E. Peebles, D. D. S., Wilmington, Ohio.



Lessons from Anesthetic Accidents and Near Fatalities, R. M. Waters, M.D., Sioux City, Iowa.

A Consideration of Ethyl Chlorid Anesthesia, Wm. Webster, M.D., Winnipeg, Canada.

A Classification of Anesthetic Signs and Cardio-Vascular Effects of Ethyl Chlorid in Anesthetic Dosage in Man, Arthur E. Guedel, M.D., Minneapolis, Minn.

The Effects of General Anesthetics on the Liver, Charles LaRocque, M.D., Montreal, Canada.

During the Symposium on Anesthesia and the Circulatory System the following papers were presented:—

Clinical Observations on the Effects of Operation and Anesthesia on Blood Pressure, C. J. Wells, M.D., Syracuse, N. Y.

Clinical Studies in Circulatory Depression from Anesthesia Records, E. L. McKesson, M.D., Toledo, Ohio.

Circulatory and Other Reflexes under Various Ether Tensions, E. A. Tyler, M.D., Philadelphia, Pa.

Blood Pressure Reactions under Ether-Oil Colonic Anesthesia, G. M. Geldert, M. D., Ottawa, Canada.

Clinical Studies on the Effects of Variable Nitrous Oxid-Oxygen Administration on Blood Pressure and Some Considerations of Rebreathing in Prolonged Anesthesia, Geo. W. Tong, M.D., Brooklyn, N. Y.

During the Symposium on Oxygen Need and Acidosis in Relation to Anesthesia and Operation the following papers were read:

Oxygen in Relation to Anoxemia and Anesthesia, R. D. Rudolf, M.D., and Thos. R. Hanley, M.D., Toronto, Canada.

A Preliminary Report on Experimental Work in Oxygen Tension during Anesthesia, Mary E. Botsford, M.D., and Dorothy Wood, San Francisco, Cal.

Further Clinical Studies in Oxygen Need during Anesthesia, W. I. Jones, D.D.S., Columbus, Ohio.

Tissue Acidosis vs. Blood Acidosis, W. H. Mercur, M.D., Pittsburgh, Pa.

Acidosis in Relation to Operation and Anesthesia, Edith M. Ross, M.D., Winnipeg, Canada.

Rebreathing and Etherization, J. R. McCurdy, M.D., Pittsburgh, Pa.

In the General Session papers were presented by the following:

The Value of Expert Anesthesia to All Concerned, (President's Address, Canadian and Interstate Anesthetists), Samuel Johnston, M.D., Toronto, Canada.

The Pathology and Treatment of Chronic Brain Injuries with a View of Determining the Safest Operative Period, Wm. Sharpe, M.D., New York City.

Postoperative Complications of the Respiratory Tract, H. Ryerson Decker, M.D., Pittsburgh, Pa.

Anesthesia for Nose, Throat and Abdominal Surgery by the Nitrous Oxid-Oxygen C. E. Combination (Honorary Chairman's Address—Official Representative of the Anesthetic Section, Royal Society of Medicine), H. E. G. Boyle, M.R.C.S, London, England

Nitrous Oxid-Oxygen for Tonsil Operations, John H. Evans, M.D., Buffalo, N. Y.

Pressure in Relation to More Efficient Ether Anesthesia, Ben Morgan, M.D., Chicago, Ills.

Handling the Toxic Thyroid under Ether-Oil Colonic Anesthesia, G. K. Dickinson, M.D., Jersey City, N. J.

Morbidity and Mortality in Obstetrics as Influenced by Anesthesia, Wesley Bourne, M.D., and W. J. Duncan, M.D., Montreal, Canada.

During the session devoted to unusual Case Reports the following interesting reports were presented:

An Unusual Cause of Obstructed Respiration, Isabella C. Herb, M.D., Chicago, Ills.

Syphilis and Anesthesia, F. H. McMechan, Avon Lake, Ohio.

Resuscitation and Sustained Circulation by the Chest Compression Method, R. M. Waters, M.D., Sioux City, Ia.

Inflation of the Atelectatic Lung in the Newborn, Wm. T. Shannon, D.D.S., Detroit, Mich.

During the Executive Session of the Canadian Anesthet-

ists the following officers were elected for 1921-22: Drs. Wm. Webster, Winnipeg, President; D. H. Arnott, London, Vice-President; F. H. McMechan, M.D., Avon Lake, O., Executive Officer for the United States; Wesley Bourne, Montreal, Secretary-Treasurer and Members of the Executive Committee Drs. J. L. Allen, Calgary, T. R. Hanley, Toronto, C. LaRocque, Montreal, and W. L. Muir, Halifax.

The minutes of the organization meetings as well as the report of the Secretary-Treasurer were accepted as read.

The Associated Anesthetists participated in the dinners and other social activities of the Ontario Medical Association, and the visiting ladies were entertained with sight-seeing trips, teas and musicales.

## Quarterly Index

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ACIDOSIS IN OPERATIVE SURGERY: OCCURRENCE DURING OPERATION AND ITS TREATMENT BY GLUCOSE AND GUM ACACIA GIVEN INTRAVENOUSLY. L. K. P. Farrar, New York City. *Surgery, Gynecology and Obstetrics*, April, 1921.

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## A CONSIDERATION OF ONE HUNDRED AND NINETY CHEST INJURIES.

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This paper is a report of one hundred and ninety chest injuries treated at Evacuation Hospital No. 8 during the Argonne offensive. It includes only those patients in whom there was a penetrating or perforating wound into the thorax. It must be remembered that all of the wounded were picked men, young and in fine physical condition.

Evacuation Hospital No. 8 was a large outfit and these men came under the care of different surgeons, many of whom are well known. There was considerable difference of opinion as to the proper procedure in looking after these chest wounds and the treatment was therefore varied.

In chest surgery the operators in the zone of the advance were roughly divided into two groups—radicals and conservatives. I saw little of British casualty clearing stations and cannot speak of them. The French were, for the most part, radical. Many of their leading men were quite radical. I heard both Tuffier and Duval discuss the subject and saw Chutro and Robin operate. The Americans were largely conservative, but a number of our surgeons were quite as radical as the French.

There was never any unanimity of opinion among us as to the best methods of procedure, and there is not much agreement even now. Not only did surgeons differ as to whether certain chest injuries should be operated upon or not, but there was also much difference of opinion as to the proper time to operate. Immediate operation had its advocates, delayed operation its advocates as well, and a great many surgeons were opposed to any operation in most instances. There were a number of things that complicated the question very much. One was the time that had elapsed between the receipt of injury and the soldier's admission to the evacuation hospital. This was, with us, rarely less than ten hours, more often about sixteen hours and often longer, so that if there were any considerable laceration of the chest wall, the wound would be heavily infected and this would, of course, seriously interfere with primary

union if a major thoracotomy were done. In order to check up the operating-room technique and keep informed as to the degree and kind of infection, we ran, every few days, a series of one hundred cultures from wounds when they first entered the operating room and before anything was done. These averaged 40% streptococcus, and the cultures from practically all wounds would grow an anaerobe.

Another difficulty was the number of multiple injuries, in which one wound was of the chest. This very often complicated the treatment. Several of the fatal cases had an injury of the spinal cord. In a number of cases both the abdomen and chest were penetrated. Gas gangrene of the chest wall was another serious difficulty. Hemothorax was practically always present, and severe hemothorax with low blood pressure and surgical shock created a difficult problem. It was hard to decide whether or not the hemorrhage was still active. Here transfusion was contraindicated as it usually raised the blood pressure and increased the hemothorax. The same thing was true of saline infusion.

Dr. Howard Lilienthal of New York, who spent considerable time with us as head of a surgical team, has called attention to a very disappointing phenomenon. On many of our fatal cases an autopsy was performed, and in a certain number of them there was found pneumonia of the opposite lung. One thinks at once that this was due to aspiration caused by the anesthetic, but the pneumonia was seen in men who were operated upon under local anesthesia and was also seen where no operation was performed.

Shock was a most important matter. I am sure that we saved quite a number of our cases by treating the shock before treating the injury. It must be remembered that during the Argonne offensive it rained every day and the nights were cold. A wounded man often lay out for hours before he was picked up, and there were many difficulties and delays in the transportation back to the evacuation hospitals. These men came in wet and cold and hungry, in addition to being wounded and often exsanguinated. So it can be seen how important was the matter of shock. We had two shock tents of thirty beds each, and during active times these were filled. We were guided almost entirely by the blood pressure as to



whether a man was a proper operative risk. If his blood pressure was below 90, we learned he would scarcely stand operation except for hemorrhage and then only if transfused.

The chest cases with low blood pressure were put in the shock ward and treated there. If the blood pressure arose above 90, they would be sent to the operating room. If the blood pressure continued to fall or held stationary, operation, if done, was usually followed by a prompt fatality. So, after a while, we did not operate upon these cases except for sucking wounds or active bleeding.

In order to simplify these problems we were in the habit of dividing chest injuries into different groups. All cases went through the x-ray room, and the roentgenological report was very helpful in the classification.

A number of wounded men had an injury of the chest wall only, without any penetration into the thorax. If the pleural cavity had not been opened, these were excluded from this chest group and the wound was treated by débridement as would any wound of the soft parts and bone elsewhere.

A number of men suffering with chest injuries came in with so-called "sucking wounds" where there was free movement of air into and out of the thorax at each respiration. These men were always in serious condition; they were cyanotic, very dyspneic, had a rapid, irregular pulse of low tension, and were very anxious and uncomfortable. Plugging the opening or closing it with sutures was followed almost immediately by marked improvement.

A very serious group that required early and radical operation was composed of men with extensive wounds of the chest wall, including a penetrating or perforating wound into the thorax. This became all the more urgent if the missile ranged downward to the diaphragm. Very often the scapula would be injured and practically always one or more ribs. If the wound were caused by shell fragments, clothing would usually be carried in and these bits of clothing were reeking with infection. Nothing was gained by temporizing with these wounds either in time or thoroughness of operation. A very radical débridement of the chest wall was indicated, having especial care to remove bone fragments which often further injured the lung or pleura. Whether to operate upon the lung at the same time was always an open question. Much can be said either way. It was most essential to get the pleura as dry as possible and to close it tightly, in order to prevent mediastinal flapping caused by a "sucking wound."

Another group was made up of those who had a large piece of shell casing in the lung, but without extensive injury to the chest wall. Here the missile went straight in. There would be hemothorax, and it was always a matter of uncertainty as to whether there was still active bleeding or not. I think there was more difference of opinion as to just what should be done with these cases than any other group treated in the evacuation hospitals.

It seemed rational to perform a major thoracotomy, remove the foreign body, suture the bleeding lung, dry the pleura, and close the chest wall. The difficulty was not in the operation, but in the results, and the determining factor was infection of the wound in the chest wall, bearing in mind the lapse of time before operation and the virulent organisms present in practically all wounds. If it had been feasible to leave the wound open, the question of infections would not have been so serious. But "sucking wounds" had to be avoided at all costs.

Then there was another group about which there was still some difference of opinion, but here most surgeons agreed. These were men with penetrating or perforating machine gun or rifle bullets and with single or multiple penetrating wounds made by small pieces of shell casing. Here there was a small wound of the chest wall, without laceration and no "sucking". Almost always there was hemothorax. I am quite sure that these did best if not operated upon early.

In the early days of my experience, I had taken care of one hundred French wounded three days after being hurt. They had passed through a French evacuation hospital. Twenty-five of them had chest wounds. Three only had been submitted to a major thoracotomy. They were all in surprisingly good condition, and they made a strong impression on me.

During the Argonne offensive, 190 injuries of the thorax were admitted to Evacuation Hospital No. 8. Of these 25 died in the shock ward unoperated because they could not be gotten in condition to warrant operation. Forty-three had a major thoracotomy done with some operation upon the lung. One of these had a wound of the pericardium as well. In this group, there were 27 deaths—63% mortality. Forty had extensive chest wall débridement, often with the pleura open, but no operation was done on the lung. There were 16 deaths in this group—a mortality of 40%. Many of these wounds had been sucking ones. The next group were not operated. They were composed of penetrating or perforating bullet wounds, or penetrating wounds made by



smaller pieces of shell casing. There were 82 in this group with 7 deaths—a mortality of  $8\frac{1}{2}\%$ .

The war has had a decided influence on chest surgery. While no new principles were brought forward, many phases of the subject have been studied and the great bulk of clinical material has helped to clarify a number of points.

The anesthesia has been greatly simplified. No cumbersome apparatus is needed. The pressure from a gas tank is all that is required to keep the lung distended. Ether can be used entirely satisfactorily. Dr. Lilienthal, when with us, rigged up a very simple outfit for giving ether in chest surgery by the use of a dentist's foot pump and an atomizer. By either of these methods the lung could be distended or allowed to collapse at will, and it did not seem necessary to measure the pressure. The operator could judge the necessary pressure by observing the lung.

There was some controversy about the method of approach as between rib resection and incision into the thorax between the ribs. The latter method required a rib retractor. It was very much easier to close the chest if ribs were not resected. All that was necessary was to suture the contiguous ribs together with strong catgut. This usually obviated the suturing of the pleura. My observations convinced me that suturing of the pleura after a major thoracotomy is very often a difficult and, at times, an impossible procedure.

The presence of hemothorax makes localization for removal of foreign bodies in the lung very misleading at times. A large hemothorax would press the lung out of its normal position, and the *x*-ray reading would locate a piece of metal. As soon as the chest was opened and the blood removed the lung would occupy a different position and the foreign body be nowhere near the point it had been located. This was often very confusing. Dr. Alleman, the *x*-ray officer, overcame this in delayed operations by making a roentgenogram before and after aspiration.

#### LUNG ABSCESS.

Acute cases of the mild type, according to most writers of experience, may be treated expectantly in the hope that drainage through the bronchus may effect a cure. These cases are such as most often follow pneumonia of a mild type, and even in these it should be understood that the presence of pus in the bronchial tree is a constant menace to other portions of the lung. In general the mortality in cases of abscess treated expectantly has been from 70 to 90 per cent.—C. A. HEDBLUM in *Minnesota Medicine*.

## PRE-OPERATIVE, OPERATIVE AND POST-OPERATIVE CARE OF THE PATIENT.

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Despite the enormous number of surgical interventions that are now daily undertaken, and the ever-increasing variety of conditions for the relief of which the surgeon's services are sought, the fact remains that to the ears of most people outside the medical profession the word "operation" has a very ominous sound. It therefore behooves the surgeon to consider the mental attitude of the patient who has been confided to his skill, and to include in the preparations for operation those psychic influences that are best calculated to bring the patient to a state of mental equilibrium comparable to the thorough physical balance which every careful operator endeavors to have set up in each subject before he enters the operating room. If the patient seems excessively apprehensive over the outcome—when perhaps a relative or friend has died or been left an invalid under similar conditions—the tactful surgeon will do all in his power to dispel unnecessary fear, and make the prognosis as optimistic as possible, but, on the other hand, it is most unwise to conceal a grave danger that really exists. The situation is often one calling for as nice judgment and discrimination as is ever exercised in the operating room, and many a surgeon who is unerring with the scalpel has blundered sadly when confronted by it.

Nothing can so well harmonize both body and mind as sleep, and therefore it is imperative that the patient should sleep well the night prior to the operation, so that he will be refreshed and in condition to undergo what to him seems a trying ordeal. It is not sufficient for him to merely rest, and the more serious the condition, the greater the necessity for deep profound sleep, even if morphine has to be administered to produce it.

We deem it very inadvisable to place patients on a starvation diet either before or after the operation, or to purge or cause any unnecessary muscular or physical exhaustion. As a short period of abstinence from food is necessary immediately before and after the surgical intervention, I prepare my patients by giving them plenty of sugar in the form of candy the day before, and with all the water they are able to take. Other diet is liquid, and alkalies are likewise administered. It is my belief that carbohydrates in the form of simple sugars can be advantageously given just prior to an operation, as they supply energy for the musculature which will be more or less de-



pleted during the enforced starvation of the operative period, and as they easily undergo oxidation in the body, serve to keep up the constant body heat and are especially valuable in replacing bodily waste.

If a cathartic is needed it is given several days before the operation and time enough is allowed for the bowels to return to normal, with a restoration of the intestinal flora which are necessarily washed out by the use of a strong cathartic. If necessary, enemas are given the night preceding operation. If the organs are functioning normally, the usual condition of shock and exhaustion can be greatly ameliorated. Doubtless all surgeons observed that the subjects of emergency operations, such as acute appendicitis cases, get along better than those who have gone through an exhaustive course of pre-operative "preparation".

#### CONTRAINDICATIONS.

*Diabetes.* The presence of sugar in the urine is a distinct danger signal and a contraindication for all surgical interference, as diabetic coma, is likely to follow any operation that may be undertaken. When diabetes is present tissue resistance is low, inviting pyogenic infection and other complications. A gangrenous process may be set up, associated with sclerotic changes in the arteries supplying the field of operation, with partial or total obliteration of the lumen, or possibly thrombosis. If a surgeon is compelled to undertake an operation upon a diabetic individual, the patient should first be prepared by careful dieting. If, as commonly the case, acidosis is present, sodium bi-carbonate should be administered. By exact measurement of the amount necessary to produce proper alkalinity in the blood a very fair estimate can be made of the patient's powers of resistance. In some mild cases, as much as fifty or sixty grams can be administered daily.

*Syphilis,* even in its active and early stages, does not contraindicate surgical procedure, provided the patient is on specific treatment both before and after operation. The danger of infection to surgeon and attendants should, however, always be carefully considered. Where syphilitic cachexia exists because of lack of treatment, or where there is a severe degree of mercurial poisoning, all surgery should be avoided. If a surgeon is ignorant of the presence of syphilis in a subject presented for operation the consequences may be very serious, as a luetic condition delays or prevents healing of the operative wounds and retards the closing of drain passages.

*Obesity* should not be regarded as a bar to operation although it adds to the risks undertaken. The tissues are more liable to infection than those of the

normally nourished individual, are more friable and easily traumatized, and do not hold sutures as well. In a fat subject a larger incision than in a slender individual is necessary to get the same results and the wound healing is not likely to be perfect, increasing the liability of hernia. Fat necrosis and fat embolism are not uncommon complications also.

Once operation is decided upon nothing is to be gained by waiting any length of time, unless the physical condition of the patient can be improved. The surgeon should not forget the anxiety which will beset even the most phlegmatic at such a time, and if the operation is set for nine o'clock and the operator does not reach the hospital until ten, the stress of waiting may cause a perturbed state of mind that will have a most deleterious after-effect. I prepare the field of operation in the usual way and the area is then coated with three-and-one-half per cent. tincture of iodine and covered with sterile towels. The patient can then be anesthetized according to the method selected for his especial case. When chloroform is to be administered the heart should be very carefully taken into consideration, but if ether is to be used, the same care should be given the lungs, as the heart will usually take care of itself.

#### ANESTHESIA.

The subject of anesthesia is one open to much discussion. Most surgeons have their pet anesthetics which they use as a routine, often seeking their own convenience rather than making a study of the needs of the patient. Too much emphasis cannot be laid on the necessity of realizing that "the patient is the first consideration, and not the prejudice of the surgeon for a certain method". Anesthetics should never be administered except by those who have been carefully trained in the use of the particular method which is to be employed, and the anesthetist should thoroughly familiarize himself with the needs of his patient. Such precautions are often neglected or deemed unnecessary, but experience has proved them to be of the utmost importance.

In order to overcome the patient's dread of the operation as far as possible, and to make the induction of anesthesia easier, it is my custom to administer a solacing dose of morphine and scopolamin about one hour before the patient is to be placed on the operating table. When dealing with the very aged, the very young, or any one whose enfeebled condition contraindicates the use of narcotics, it is, of course, omitted. In giving morphine in this way we have two objects: to lessen the effect of pre-operative psychic influence, and to actually hinder in some measure the damage to the organs of the kinetic



system resulting from the process of operation. Morphine is especially useful in cases where emergency operations must be performed. It inhibits nerve impulses, damaging in character, from reaching the brain, thus lessening the effect of the operative trauma. Under these conditions it should not be given in a single dose, but in repeated doses at intervals, until the desired effect is produced and the pulse rate is lowered enough to prevent too great a waste of the patient's already depleted energies.

In our work we employ four anesthetics; nitrous-oxid-oxygen; local anesthesia; spinal anesthesia; or a combination of nitrous-oxid-oxygen with local anesthesia.

*Nitrous-oxid* should be given only by one thoroughly familiar with all the details of its administration. Under these conditions it is perhaps the safest of all anesthetics. It is practically odorless; a few inhalations and quite enough to induce loss of consciousness; it is much less apt to cause vomiting than ether, and its effect upon the cells of the brain is very much less exhausting. A patient who has once taken this form of anesthesia does not dread it a second time, while anyone who has previously taken ether is almost certain to retain a lively consciousness of the unpleasant after-effects and to feel great reluctance about passing through them again. Ether is irritating to the bronchial passages, and has a drying effect upon the tissues. In such conditions as acute abdominal infections the use of ether should never be permitted, for its action upon the phagocytes—the cells upon which a patient with a severe pyrogenic infection must depend—greatly weakens the patient's powers of resistance, so that he is far more liable to succumb to the infection than when nitrous-oxid-oxygen is the anesthetic employed.

In the beginning of all our abdominal operations we infiltrate the skin at the line of incision with a solution of one-half of one per cent. *novocain*, while the patient is under the influence of nitrous-oxid, being careful to inject very thoroughly all the tissue to be divided, so that no nerve filament is omitted. This makes possible a clean, sharp dissection, and the abdominal walls are perfectly relaxed so as to offer no resistance to the manipulations of the operator. This is an admirable anesthetic to be used locally, or in conjunction with general anesthesia. When properly injected, the part is immediately rendered insensitive, the condition of anesthesia lasts for an hour or more, but does not in any way interfere with the prompt closing of the wound. We have repeatedly done operations of considerable importance with this

anesthetic alone, such as the removal of hemorrhoids or superficial growths, rib resection in empyema, or the reduction of hernia, and we have even done Cesarean section without the addition of a general anesthetic.

*Spinal anesthesia* we have employed repeatedly, and always with the most highly gratifying results. We have found that it completely anesthetizes the part below the point of injection, blocking all nerve impulses, and yet producing none of the disagreeable sensations that invariably result from the use of any general anesthetic. We have employed it in extirpation of the prostate gland, in vaginal hysterectomy, for fistula in ano, during amputations, and in various other major operations where the life of the patient hung in the balance, and we feel certain no other anesthetic could have been so successfully employed. If a patient is pulseless—or practically so—because of a traumatic injury, he should not receive a spinal anesthetic until reaction sets in, and its use is not advisable in cases of collapse as a result of ileus, peritonitis, or an infected biliary system. Where pleuritic effusion or massive intra-thoracic growths have limited breathing area, spinal anesthesia, as well as all other forms, is likely to be attended with serious consequences. This form of anesthesia was used by Dr. Sanders at the Kansas City General Hospital in some three thousand cases, in which it was my good fortune to watch and assist. In but one case was there any bad result. This patient developed a dragging toe of one foot, but even in this case there was a possibility of the condition pre-existing the operation. When brought to the hospital he was in a state of coma, with a condition of urinary retention which necessitated immediate surgical interference, so that no careful examination was possible beforehand.

We have employed spinal anesthesia in a variety of conditions on patients ranging in age from the newly-born to ninety-three. It can frequently be used where any other form of anesthesia would be sure to produce dangerous complications. In our opinion there is no other anesthetic method that gives a greater degree of muscular relaxation with less danger. In adapting the dosage when the patient is a child, its size and strength should be considered rather than its age. Thus a child less than six months old can with safety be given 1.5 centigrams of *stovaine*, a child of five about 2.5 centigrams, and one ten years old 5 centigrams. We now use Babcock's solution entirely, compounded by the following formula:



Stovaine .....	0.08 gms.
Lactic acid .....	0.04 cc.
Absolute alcohol .....	0.2 cc.
Distilled water .....	1.8 cc.

As the operating surgeon is to administer the anesthetic it is of course absolutely necessary that he be familiar with every detail of the technique of spinal anesthesia. The patient is prepared the night previous to operation in the same manner as when a general anesthetic is employed. If he is psychically disturbed in any way we give morphine gr. 1-6 and scopolamin gr. 1-150 forty-five minutes before conveying him to the operating room. The back is scrubbed and prepared by painting the site of the puncture with three-and-one-half percent tincture of iodine, and covered with sterile pads. The patient is seated upon the operating-table, his feet hanging over the edge. He then is bent forward, supported by the nurse, and the back is covered with a sterile sheet with a small opening over the site prepared for the puncture.

In abdominal operations the point selected for the injection of the anesthetic is about on a level with the area where operation is to take place. Thus, in cases where the upper abdominal viscera, the stomach or the gall-bladder are to be operated upon, the twelfth dorsal space is the point selected; if the lower abdomen is the site of operation, the injection is made between the second and third lumbar vertebrae. As a rule, the lower injections are safer; if the point of puncture is made higher up, the lower dorsal nerves may be involved and respiration interfered with. We use a long needle, preferably of gold or platinum, with a tight-fitting stylet to prevent plugging. This is inserted in the midline of the spinal canal at right angles to the body, about the center of the selected interspace. As the needle enters the interspinous ligament considerable resistance is encountered, but when this is passed it glides easily until slight resistance is again experienced on entering the dura. The stylet is now withdrawn and the spinal fluid should flow freely.

A syringe is next attached to the needle, five to ten cc. of spinal fluid being withdrawn. This is mixed with the anesthetizing solution and the whole replaced in the syringe and injected. The needle is then withdrawn, and if the solution used is lighter than the spinal fluid, the patient's head is placed at least two inches lower than the hips, thus preventing an upward diffusion of the drug. It should have been previously explained to the patient that he will feel a slight prick and that immediately thereafter his

lower limbs will become numb. If this precaution is omitted he may become very much frightened on discovering that he is unable to move them. In operating upon a conscious subject the surgeon must take account of the psychic element, in addition to the technical details of the operation, which increase his responsibility not a little, and to the minds of many, constitute a very serious objection to the use of spinal anesthesia.

In operations where the vitality of the patient is at a low ebb, or where profuse hemorrhage has taken place the margin of safety may be widened by *blood transfusion*. In skilful hands this is a most valuable procedure in conditions of profound exhaustion, anemia or sepsis. We have made use of it with great success on many occasions.

There are many conditions, as where cancer of the gastrointestinal tract or large ulcer masses are present, in which it may be desirable to perform the *operation in two stages*. Under such circumstances the plan above outlined should be carefully adhered to, and should commend itself to every thoughtful surgeon. By making use of this method of anoci-association the fears of the patient are not increased by the experiences of the first step in the operation, so that he is able to approach the second stage without undue disturbance, either physical or mental. When this method is employed throughout, the two-step operation is much more easily accomplished. Not infrequently when it is planned to perform an operation in two stages—as for instance a gastro-enterostomy to be followed by a resection—the second step has been found unnecessary, the mass entirely disappearing, so that the stomach resumed its normal functions and resection was not required. Thus an additional and dangerous operation was obviated. Drainage of an appendiceal abscess or of an infected gall-bladder can be quickly accomplished in the first stage, and an already exhausted patient does not undergo the hazard of a long and sometimes quickly as is consistent with good surgery.

The essential points in the management of *acute peritonitis*: The Crile method is paramount,—

Nitrous-oxid-oxygen anesthesia.

Local anesthesia at point of incision.

Clean-cut wound, lessening shock and liability of infection.

Adequate drainage.

Large hot flannel packs placed over the entire abdomen, well up on the chest and around the sides to the bed line.

Fowler's position throughout.



Five per cent sodium bicarbonate with five per cent glucose by Murphy drip, continued as long as it is tolerated.

Primary lavage of the stomach, repeated if necessary, although it is rarely required if anoci-association is complete.

From 2,500 to 3,000 cc. of physiological sodium chloride solution administered subcutaneously every 24 hours until the period of danger is past.

Morphine given hypodermatically until the rate of respiration is reduced to 10 to 14 per minute, and held there until danger is past.

In streptococcus peritonitis morphine is not useful.

#### POST-OPERATIVE CARE.

Immediately upon the completion of the operation the patient should be carried to bed, and sufficiently covered to be kept thoroughly warm without sweating. Water should be given freely, also alkaline saline proctoclysis by the Murphy method as long as it will be tolerated. If the fluid drip is not retained the solution may be given in bulk. Hypodermatoclysis of physiological salt solution may be administered if necessary. To allay gas pains, a hard rubber tube, long enough to pass the internal sphincter and about the size of the forefinger, is inserted in the rectum. Should oozing hemorrhage take place such preparations as horse serum, thromboplastine, or coagulose may be given, but the best method of checking hemorrhage has been found to be placing the patient in a nearly upright position immediately after operation. This cannot be done in the case of very elderly patients. As soon as the hemorrhage stops the patient may again be allowed to recline, so that the circulation to the brain will be restored. By lowering the blood pressure in this way the patient is brought to the verge of fainting, and coagulation is facilitated.

Finally, *sleep* is the greatest necessity for restoring the patient to health and vigor. Morphine should be administered freely enough to keep the patient comfortable, and the surgeon should concern himself in regard to this, not leaving the amount or the frequency of the administrations to the judgment of a nurse. It is useless to take elaborate precautions to avoid all shock in the operative procedure, only to let the patient exhaust his vitality by the action upon the kinetic system of the effects of trauma, fear and toxins, all of which may be avoided by the intelligent administration of morphia, in small, frequently repeated dosage. We use morphine, 1-32 to 1-16 of a

grain, with scopolamin, gr. 1-200, every three or four hours for the first twenty-four hours after operation. It is seldom necessary after that.

A summary of the care which should be given to a patient, before, during and after operation is:

Plenty of water and carbohydrates before and after operation; neutralizing the acids.

Proper selection and administration of the anesthetic.

Avoidance of over-taxing the patient by too long an operation; use of the two-step operation if necessary.

Clean-cut surgery that does not traumatize the tissues and invite infection.

Abundance of sleep.

206 McMILLEN BUILDING.

#### GASTRECTOMY

#### A NEW OPERATIVE TECHNIQUE

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Gastrectomy is the only treatment that can be used in carcinoma of the stomach, and it is also, in a good many cases, the best treatment for ulcer of the stomach. For this reason it appears to become more and more indicated as a procedure.

It is necessary that the technique of this operation be regulated in its utmost details, so that the mortality be reduced as much as possible.

For the last two years I have had occasion to perform a good many gastrectomies and thanks to this, I have been able to perfect my method of operating. I believe that the clamps that I have devised, which have been so favorably received by nearly all my French colleagues, constitute a real progress. The presentation of my developed technique is the purpose of this paper.

*Preparation of the Patient Before Operation.* Whenever possible I make my patients follow a treatment, the prime object of which is to avoid infection of the sutures of the stomach.

Important are the care of the mouth and teeth, so as to decrease possible contamination of fluids taken, then daily stomach lavage, except in patients subject to gastric hemorrhages. This has for its objects to cleanse the stomach and to accustom the patient to this procedure after operation, when it is absolutely necessary.

I have never attempted to alkalinize the patient's secretions and I have never noticed any of those cases of acidosis so often referred to both in France and abroad.



*Anesthesia.* This can be general, spinal, regional or local.

Ether anesthesia usually suffices, the patients sleep well with a moderate dose, but they often breathe rather stertorously, salivate much and sometimes present difficulty in closing up the belly. This can be decreased by injecting, prior to operating, 1 cgm. of morphine and  $\frac{1}{2}$  milligr. of scopolamine. Scopolamine has a peculiar action on the salivary glands and dries them up nearly entirely. I prefer to use nitrous oxid to ether. Under the influence of my friend Ambard, I was one of the first to employ it in 1912, at a time when it was not in common use in France.

Spinal anesthesia, by injection of 3-4 of a cgm. of stovain Billon, associated with very slight ether anesthesia has given me very good results and this is the method which I use most frequently. (Bavaut,

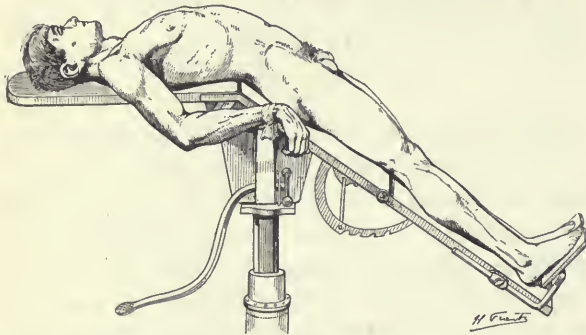


Fig. 1. The patient is placed with the head and upper part of the trunk horizontal. The lower limbs and the lower part of the trunk are inclined downwards.

with whom I have discussed this, prefers novocain to stovain, which causes a precipitate in the spinal fluid.)

In spinal anesthesia the shock is just as severe as in general anesthesia, but it causes remarkable immobilization of the abdomen and complete relaxation of the walls. This condition helps considerably during operation. The slight general anesthetic, which I use simultaneously, prevents the patient from witnessing his own operation and is chiefly used for its psychic effect.

Paravertebral regional anesthesia is theoretically the best method to use. Unfortunately it is rather difficult to accomplish. It necessitates a large number of injections. It can be used only when there is an assistant, especially trained for this method. Occasionally, even in expert hands, it produces only relative anesthesia, which is not sufficient.

Next to paravertebral anesthesia, we have the combination of local anesthesia, for opening the abdominal cavity and anesthesia of the celiac plexus, for the

intra-abdominal work. I have seen Pauchet use this method twice with very good results.

Local anesthesia alone, sometimes sufficient for gastro-enterostomy, is absolutely insufficient for gastrectomy.

*Position of the Patient.* I always place my patients in a position similar to that used in operating upon the gall-bladder. The head and the upper part of the body are horizontal, while the rest of the body is inclined downwards (figure 1).

This exposes the gastric region. The small intestines do not tend to invade the operative field and are easily kept in position in the lower part of the abdomen. The only inconvenience is that, particularly in older people, there is great fatigue after operation.

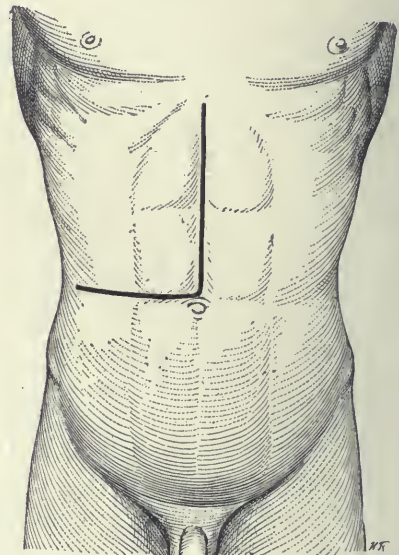


Fig. 2 L-incision. At first only the vertical incision of the L is made. If gastrectomy is decided upon, the transverse incision is made.

It is necessary, in order to sew up the abdominal walls, to bring the patient back to the horizontal.

*Incision.* I make an incision from the xyphoid cartilage to the umbilicus, and nearly always this easily exposes the lesion.

If I decide to perform a gastrectomy, a small retractor is introduced between the stomach and the abdominal wall, to protect the abdominal cavity and its contents during the execution of the transverse branch of the L-incision, which I use for a gastrectomy, as soon as I find that by having only a median incision I have the slightest difficulty in discovering the duodenum.

I make this transverse incision from the lower extremity of the median incision, that is to say from



the umbilicus, to the external border of the right rectus and even further (figure 2),

I incise first the skin, then I ligate the small blood-vessels with fine catgut. This done, I incise the sheath of the rectus muscle, then the muscle itself, meantime clamping and tying any spurting blood-vessels.

All that is left then, is to incise the posterior sheath and the parietal peritoneum, so that the angular flap can be brought upwards and to the patient's right. The angular flap is limited by the L-shaped incision and fixed to the abdominal drapery with small tissue forceps (figure 3). The amount of space, that this



Fig. 3. This picture shows the view which the L-incision gives of the pyloric region of the stomach, the gall-bladder, the angle of the colon and the duodenum.

incision gives, is remarkable and as far as the strength of the wall is concerned it does not decrease it, providing the muscle sheaths are reconstructed. The muscle is not deprived of any of its nerve supply and as a result of the transverse incision, has one extra fibrinous intersection. This incision also works very well in gall-bladder surgery. The only drawback is that it will take five or six minutes to perform it, and to close it well it takes about twice the time, it therefore prolongs the operation about a quarter of an hour. A long time ago, however, I gave up the belief in rapid operations and my faith in

easy and careful operations increases every day, therefore this objection as to slowness does not bother me very much.

*Looking Out For the Fixed End of the Small Intestines.* Before attempting anything else, I look for the first portion of the small intestine. About 30 cm. away I block the rest of the small intestine by means of small clamps and place it on a large dressing.

*Separation of the Colon and the Omentum.* The assistant takes the colon in his left hand and the great omentum with his right hand and brings forward the omentum so as to present the posterior surface to the scalpel of the surgeon. Very often, the posterior surface of the omentum is united to the anterior surface of the transverse colon by a thin peri-

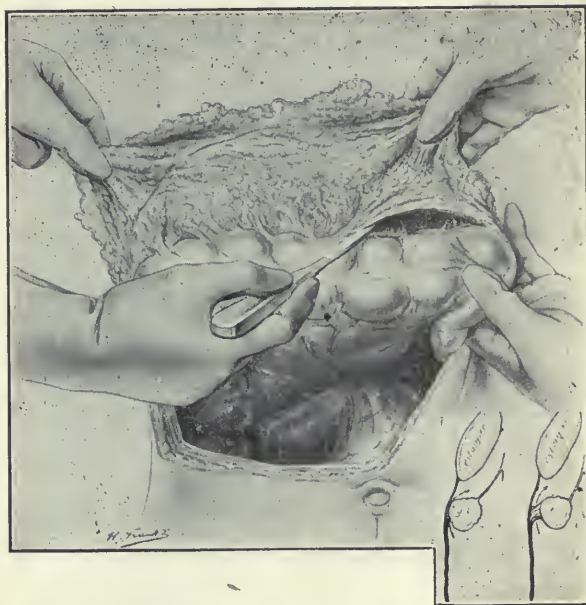


Fig. 4. This picture shows how the detachment of the omentum from the colon is accomplished, by the method of Lardennois and Okinczyc. The insert shows the two conditions that may occur: In one case, one dissects off the omentum from the transverse colon; in the other case one enters the lesser sac by dividing an avascular peritoneal veil.

toneal veil which is sometimes fairly long. It is easy to incise this and thus enter into the lesser peritoneal cavity; there is not required in these cases any detachment of the omentum from the colon (figure 4). Occasionally, however, the great omentum lies directly on the transverse colon. In such cases the separation is started by drawing a line over the serous covering of the transverse colon. Once this is started, it is easily carried on towards the posterior wall, although several strands may unite the anterior surface of the mesocolon to the posterior surface of the omentum. The separation must be started on the



left side of the transverse colon and carried on from left to right.

When this separation is accomplished, the second portion of the duodenum and the head of the pancreas, (anterior surface), the first portion of the duodenum, the pylorus and the stomach (posterior surface), are clearly seen and the surgeon performing the operation cannot help but feel thankful to Lardenois and Okinszyc who devised this method of approach.

*The Bloodvessels of the Greater and Lesser Curvature at the Level of the Proposed Incision of the*

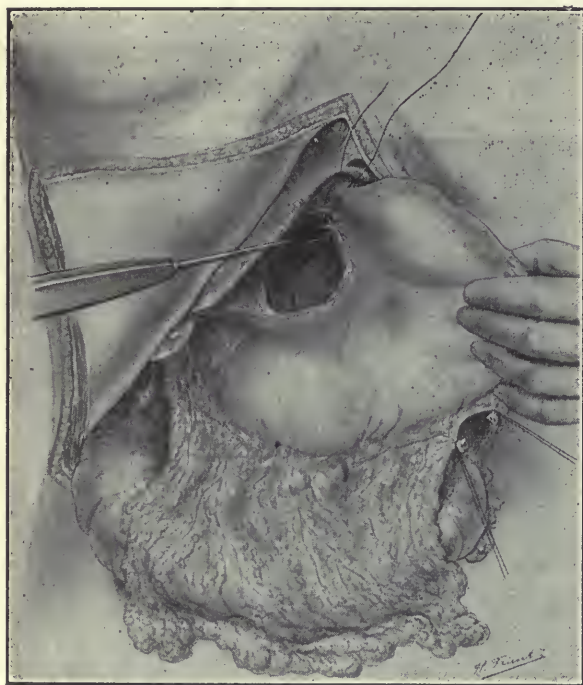


Fig. 5. The vessels of the greater curvature have been cut between two ligatures at the point where the stomach is to be sectioned. The great omentum has been divided at the same level. A ligature has been passed under the coronary artery and is about to be tied. This ligation is sometimes very difficult in fat individuals, and this drawing is poor because it does not give an idea of this difficulty.

*Stomach.* Once the omentum is detached it can be lifted with the stomach so that one looks at the posterior surface of the latter. It is then easy to pass, from behind forwards a dull needle or a clamp between the bloodvessels of the greater curvature of the stomach. Two threads of linen, one white, the other black, so that they are not confused, are then passed through and the bloodvessels are tied at two different points about 3 or 4 cm. apart. It is also necessary to tie with very fine catgut, at the level of the stomach, all the branches that come from the bloodvessels, between these two ligatures (figure 5). These bloodvessels can then be cut and separated en-

tirely from the stomach without any loss of blood. The stomach is then freed for a sufficient length to easily apply the crusher.

I have used the method of Temoin, but I find it rather brutal and it often causes severe bleeding from the stomach.

Up to now only a slight opening has been made in the omentum. It is best to complete the incision to the free border. This can be done, either by mass ligatures (if it is not too long or too thick) corresponding to the vessels of the greater curvature of



Fig. 6. One of the three pieces of the crusher, made with two jaws articulated at one end.

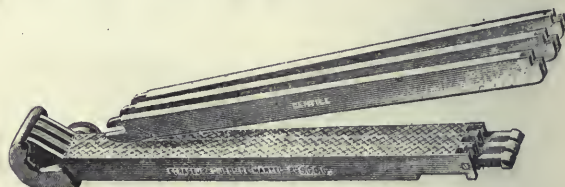


Fig. 7. The crusher demounted. The lower jaw formed by the juxtaposition of the three lower segments, is held together by a shoe. The upper jaw also consists of three segments.

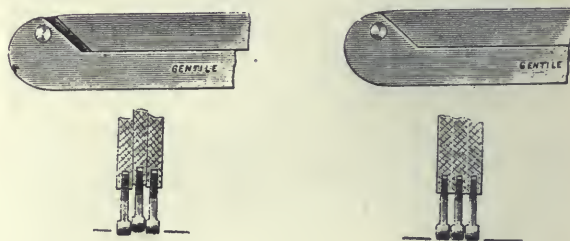


Fig. 8. Showing the three pieces assembled correctly and incorrectly. Improperly assembled, the instrument will not close and will break.

the stomach or in using only a few ligatures to tie part and accomplishing the rest of the hemastasis by a series of chain ligatures, below these. If the omentum is thin, hemastasis, by this method is easy. It suffices to cut the avascular areas with scissors, ligating all large bloodvessels that traverse the path of incision. The pieces of omentum thus obtained will be very useful to cover up and surround the stumps of the stomach and duodenum, which never can have too much peritoneal covering.

*Ligation of the Coronaries.* A large retractor, introduced under the liver, lifts up this and the left side of the incision, so as to expose well the anterior surface of the fundus of the stomach, the lesser curvature in its superior portion and the cardia.

With the finger, the avascular portion of the lesser



omentum is ruptured and torn down to the falx formed by the parietal peritoneum raised by the great vessels of the stomach.

The index finger in certain cases can catch hold easily of these vessels and they are clamped and ligated under the eye, if the patient is thin and the peritoneal fold is not full of fat. In the other cases the ligation of these bloodvessels is not very easy and a

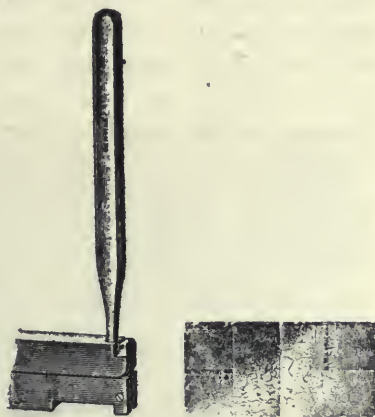


Fig. 9. Showing how, with a lever movement, the crusher is opened by disengaging the lock bolt with a small special instrument or with a grooved director.



Fig. 10. The vice in place on the crushing clamp. The heel of the attached lever presses the segments into their mortises.

bloodvessel may escape and bleed freely when cut. In this case it is best to proceed in the same way for the lesser curvature as for the greater, but the passing of two ligatures on the bloodvessel is a little more difficult. The bloodvessels are in direct contact with the stomach and often spread on both surfaces of the viscus.

I usually gather together veins and arteries in a bunch which I press between the thumb and index and introduce underneath the two ligatures on the

blunt needle. Then I cut the bloodvessels after having tied them.

On pulling upon the pylorus I detach the bloodvessels of the edge of the stomach and enlarge the opening created in the vascular arch of the lesser curvature so as to have plenty of room to place the crusher without squeezing within it the stumps of the ligated bloodvessels. This detachment sometimes ruptures

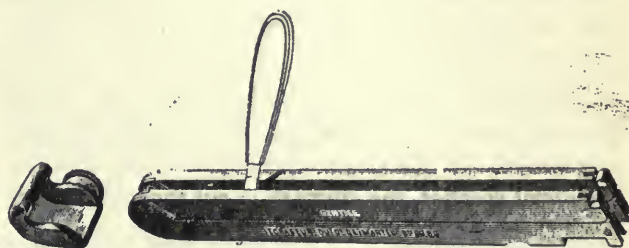


Fig. 11. The shoe that holds the three segments together is removed. The central segment has been removed. The scalpel is passed along the inner face of the distal segment.



Fig. 12. The crusher, in place, is locked and then tightly closed with the help of a vice which is then removed.

a few vascular branches at the edge of the stomach, which can be clamped and tied.

In cancer cases there is a real advantage to cut the coronary artery near its origin. The distal portion of the vessel can then be detached by scratching with a scalpel. In this way all the lymphatic glands of the lesser curvature can be removed.

All these maneuvers made necessary by the ligation of the coronary artery become very difficult in tumors of the lesser curvature next to the cardia. The bloodvessels are in the involved area and their isolation is



sometimes impossible. In these cases, all that can be done, is to cut and ligate whatever bleeds.

*Section of the Stomach.* The lower segment of the crusher is placed under the stomach (figure 7). The three upper branches are put in place. When these are brought together they form the upper segment of the apparatus which crushes the stomach (figures 10 and 12). When the two pieces are brought together, the assistant manipulates the lever and this puts in the places the three locking cleats. The instrument is closed.

The screw and the shoe, which keep the three crushers together, are removed. The middle crusher is removed. In the space where it was, and close to the distal crusher, the stomach is cut through with a

*Liberation of the Stomach. Section of the duodenum.* By using the distal crusher as a tractor, the portion of the organ to be removed is elevated (figure 16).

Occasionally on its posterior surface it adheres to the pancreas. In that event, depending on the case, it must be liberated by separating with a gauze compress or a scalpel. It is very necessary that the anatomy of this region be kept well in mind, remembering that under the inferior border of the pancreas, at the duodeno-jejunal angle are found the superior mesenteric vein and artery and also the root of the meso-colon. When adhesions exist with the trans-

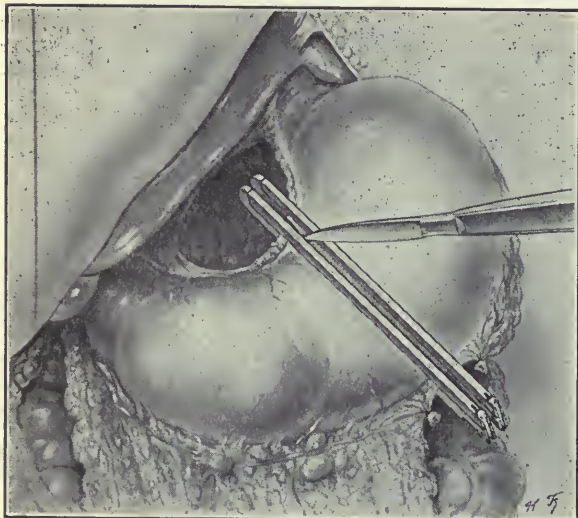


Fig. 13. The middle segment has been removed. The scalpel divides the stomach along the face of the distal segment.

scalpel without any danger of soiling the operating field (figures 11 and 13). Beyond the crusher situated on the gastric (proximal) side is thus left projecting a flap of crushed gastric tissue, strong enough to hold an overcasting suture passed close to the surface of the crusher (figure 14).

This gives an edge, easy to invaginate, and holding the stomach well closed, as can be seen as soon as the crusher is removed (figure 15). To invaginate the line of suture, begin the invaginating sero-serous stitch in the middle. In this way two pleats are formed in which it is easy for the assistant to push in the two ends of the stomach, by using a pair of non-serrated forceps. The angles of the stomach are rather difficult to invaginate if one starts the invagination suture at either of these ends of the line of section.

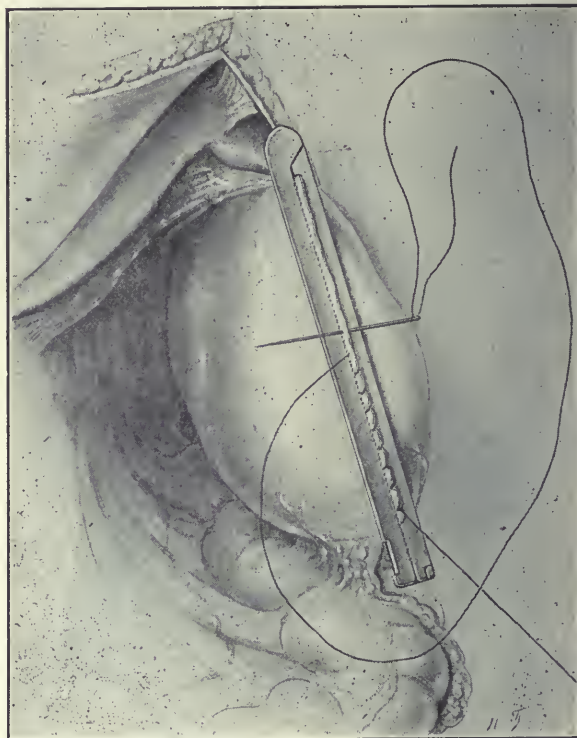


Fig. 14. Beyond the proximal segment of the crusher projects a flap of crushed stomach, through which is passed an overcasting stitch, on the free surface of the clamp.

verse meso-colon, it is easy to injure the arteries of the colon, and it is sometimes best, as I have to do several times, to resect the transverse colon. I once had to resect with the stomach the middle portion of the pancreas; the superior mesenteric vein and the beginning of the portal vein were exposed at the bottom of the wound. The patient died of a thrombosis of the superior mesenteric artery.

The stomach is brought over to the right, the pylorus and the first portion of the duodenum becoming stretched and prominent.

The pancreatico-duodenal artery is tied at its



origin. Nevertheless one must also tie the vessels on the superior and inferior borders of the first portion of the duodenum and the pylorus. Only direct hemostasis here will afford absolutely dry incisions.

Depending upon whether we are dealing with a carcinoma or an ulcer, the omentum is removed or not. To remove it, all that is necessary is to freely strip it from the inferior border of the pyloric end of the stomach and from the anterior surface of the second portion of the duodenum.

At the same time the right gastro-epiploic artery

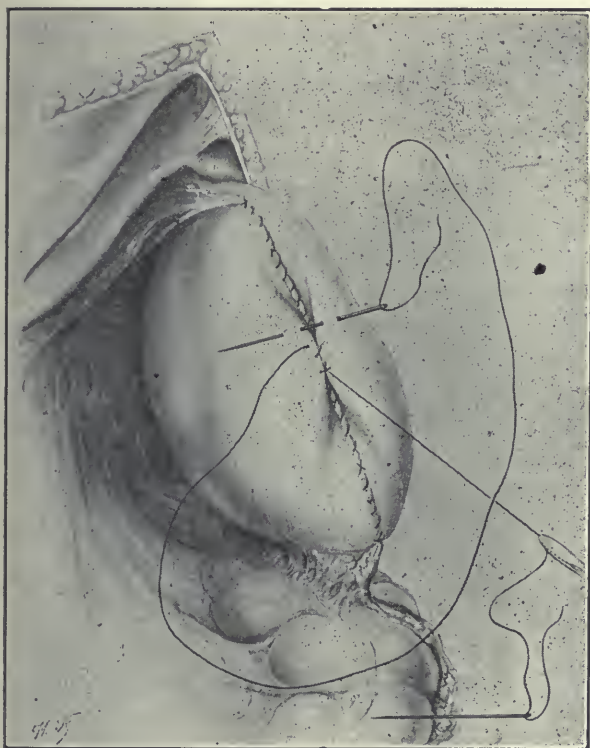


Fig. 15. Invagination of the crushed and sutured margin. The invaginating suture is begun at the center to facilitate the infolding of the angles.

is freed and it is tied as its origin from the pancreatico-duodenal artery.

To keep the omentum, it is left adherent by its right end to the anterior surface of the pancreas and the second portion of the duodenum.

*Section of the duodenum.* By ligation of the pancreatico-duodenal artery and by direct ligation of the arteries of the superior and inferior borders of the duodenum, hemostasis of the proposed incision of the duodenum is accomplished, and the section may now be made:—

*First method.* The small Mayo crusher being put in position, the intestine is cut on the surface of this clamp, between it and a Kocher forceps which closes the pylorus. An overcasting sero-serus suture is

then passed, over the crusher from one surface of the duodenum to the other. The crusher is then opened and, before the two crushed surfaces have had time to separate they are invaginated imperfectly by traction on both ends of the suture. This is the method followed by the Mayos and Pauchet.

The invagination thus obtained is not perfect, particularly at the angles and it must be supported. This can be done by tying the two ends of the purse string. All that is necessary after this is a few stitches. This method has the advantage of not producing any cavity between the through-and-through and the invaginating sutures.

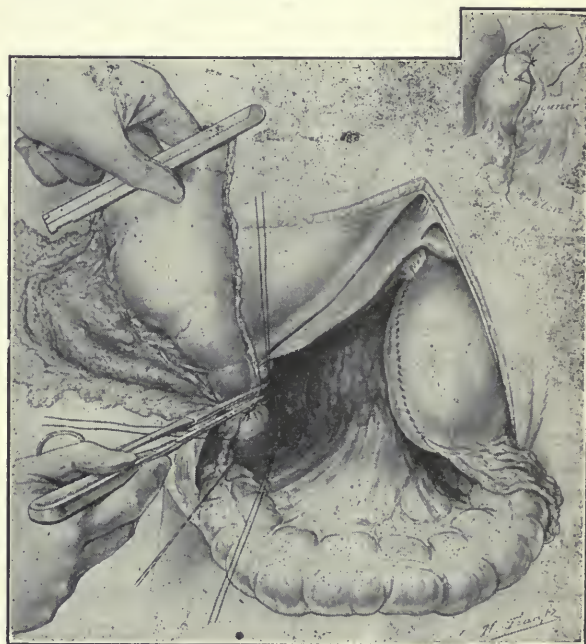


Fig. 16. The duodenum is tied with horsehair, knotted firmly about it. The inverting purse-string suture is in place. By using the distal segment of the crusher as a handle, the divided stomach can be lifted up without any fear of soiling.

*Second method.* The duodenum is crushed and tied in the crushed groove with horse hair. A purse-string suture is stitched around the intestine, below the crushed groove. The intestine, closed by a clamp, is cut above the horse hair. The stump which is left is pushed in and the purse-string pulled tight.

The stump is well buried, but it sometimes happens that the duodenum, devoid of peritoneum on its posterior surface, gives way at this point and that tying the horse hair in the crushed groove becomes impossible.

*Third method.* This is identical with the preceding, but without using a crushing clamp. The duodenum is ligated with a heavy horse hair which is drawn very tight. A purse-string suture is passed



below the ligation, the stump is invaginated in the center and the purse-string is tightened (figure 16).

I prefer this last method, but it necessitates, as do the other two, that at least 1 cm. of the posterior wall of the duodenum be conserved. When this is not done, the invagination is defective, and certainly here is the one real difficulty in the operation.

The majority of cases of gastrectomy that terminate fatally die from infection starting from a duodenal stump that has not been well closed. One is apt to forget that intestinal and gastric sutures only hold because of the wonderful soldering quality of the peritoneum. Without this quality intestinal surgery would not exist. The duodenum has no peritoneal covering on its posterior surface, therefore it is always necessary, after the invagination, to support it with a supplementary invagination by stitching the peritoneum of the anterior portion of the duodenum with the peritoneum, unfortunately very friable, of the anterior surface of the pancreas and, especially, by covering the whole with a piece of omentum, kept for this purpose.

*Gastro-enterostomy.* Gastrostomy having been accomplished, bleeding points are looked for and all that is necessary to do now is to reestablish continuity of the intestinal tract by a gastro-enterostomy.

I have tried all types of gastro-enterostomy and found them all, after gastrectomy, satisfactory. I therefore now use the one which is easiest. In reality it is because they are easiest that I use only two different methods. I either attach the whole length of the cut end of the stomach, or a portion of this section, in the free border of the jejunum, pulled through an opening in the meso-colon and for this case I keep the stomach closed with the crusher during the whole operation or, having invaginated the cut end of the stomach, as described above, I perform an anterior gastro-enterostomy parallel to the section of the stomach and to its left. This is the method which I most often find indicated.

Gastrectomy, performed as here described, has given me very good results.

#### PERFORATING ULCER.

A perforating duodenal ulcer, resulting in septic peritonitis, demands immediate interference; otherwise, a very high mortality is the result. Because of the sudden, acute, agonizing epigastric pain accompanied by great shock that characterizes the perforation of a duodenal ulcer there should be no hesitancy in operating on these cases at once.—J. P. RUNYAN in the *Southern Medical Journal*.

## PLASTIC AND COSMETIC SURGERY OF THE HEAD, FACE AND NECK.

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NEW YORK, N. Y.

### III. CORRECTION OF NASAL DEFORMITIES. (RHINOMETAPLASTIE).

By GUSTAV J. E. TIECK.

Only a few centuries ago surgery was considered beneath the dignity of the physician and was the lighter occupation of the barber. As years brought knowledge and decades studious thinkers, that great subject was lifted from its lowly position of levity to be placed on a pedestal of necessary practice. Surgeons were given birth.

Just as surgery fought its forward way to recognition, so have each of its branches experienced the same opposition in the endeavor of their exponents to lift to a higher and individual plane those subjects of their interest, worth and labor. While the operation of staphylorrhaphy for a congenital cosmetic defect was tolerated by the profession which, like society in general, was so omnipotent, judicial and fickle, other measures for cosmetic improvement were left to incompetent adventurers, advertisers and quacks. Even in the present swiftly-changing, kaleidoscopic period, an author of a work on the intricacies of plastic surgery humbly presents to the profession a jewelful book and urges this specialty behind the noble subterfuge that the world war has demonstrated beyond doubt the need of this as a special branch!

No apology is extended to the reader by either author of these articles. The labors involved have been long and often wearisome, as is always the case with those who work on unexplored and unhewed roads. The world war was only one demonstrative factor that called on the profession to give trained specialists to succor its facially maimed and deformed. In that unjustified conflagration men who had been happy in their birthright of regular features refused to tolerate facial disfigurement that could be corrected. How much greater, therefore, is the justice of the cry of those who from the cradle have been the victims of featural deformity!

Those who have always felt that their ascendent duty was to heal rather than beautify may learn that the two practices are not dissimilar. A solitude sought through undesired, fanciful imaginings, psychic depression and even deep dejection, to end in suicide, are not infrequent resultant symptoms and endings of those individuals profoundly unhappy in their own appearance. When facial disfigurement is such as to cause serious social or business embarrass-



ment, it becomes a real and potent cause of unhappiness. Young women of marriageable age feel keenly the disadvantage of distorted features. Not vanity, but only deep concern and worry are at bottom the cause of most cases that come to the plastic surgeon. Their own irregularities are mirrored to them through a deceived eye. This can be appreciated by the anxious, expectant expression of the patient as he awaits an opinion as to the possibility of a corrective operation. His suspense is as serious and pitiful as his happiness is rapturous and unconfined on receiving an affirmative answer.

Among the abnormal featural derangements, none causes more perturbation than the misshapen nose, be it the result of injury, heredity or disease. It has been stated already in the article on history of plastic surgery that this difficult and technical field originated with rhinoplasty. This subject properly deals



Fig. 1. Front and profile views of two patients before operation.

with replacement of missing parts of the nose. Rhinometaplastie (Joseph)\*, or the correction of nasal deformities, is the subject I shall first describe. Before considering any surgical therapeutics involving this important organ, it is advisable that the following brief review of the anatomy of the nose and of certain general fundamentals of grafting be perused.

The nose consists of an anterior prominent part composed of bones, cartilages, muscles and skin, and two nasal fossae. There are five cartilages, two upper and two lower lateral, and the cartilage of the septum. The upper cartilage anteriorly joins its fellow and the cartilage of the septum and posteriorly is in connection with the nasal process of the superior maxilla. Inferiorly it joins the lower lateral cartilage. The lower lateral cartilages are peculiarly curved to form the nostrils in the middle and sides,

\*In this and future articles on this topic, I shall use the terminology and classification originated by Jacques Joseph of Berlin.

and are open behind. Each is connected to the nasal process of the superior maxillary by fibrous membrane. Above, they join the upper cartilage and the cartilage of the septum. The latter is attached anteriorly with the nasal bones, the two upper lateral cartilages and the two lower lateral cartilages, while posteriorly, it joins the perpendicular plate of the ethmoid and is attached to the palatal processes of the superior maxilla and the vomer below.

The nasal fossae are separated by the septum nasi. They are joined in front by the anterior nares and behind by the posterior nares. Each has a roof, floor, inner and outer wall. The roof is formed by the nasal bones, the cribriform plate of the ethmoid, the nasal spine of the frontal bone, the inferior surface of the body of the sphenoid, the alae of the

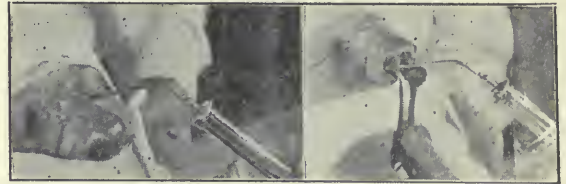


Fig. 2. Intra- and extra-nasal anesthetization.



Fig. 3. Forming a pocket for the transplant.

vomer and the sphenoidal ciliated processes of the palate bones. The floor is composed of the upper bones and the palatal processes of the superior maxilla. The inner wall is made up of the cartilage of the septum, the crest of the nasal bones, the nasal spine of the frontal, the perpendicular plate of the ethmoid, the vomer, the rostrum of the sphenoid and the crest of the superior maxillary and palate bones. The outer wall is formed by the nasal processes of the superior maxilla, the lachrymal bone, the ethmoid, the inner surface of the superior maxilla, the inferior turbinate, the vertical plate of the palate bone, and the pterygoid plate of the sphenoid.

The superior and middle turbinate processes of the ethmoid, and the inferior turbinate project inwards from the outer wall, and in so doing, divide each fossa into a superior, middle, and inferior meatus. Into the superior meatus open the sphenoidal and posterior ethmoidal cells. Into the middle meatus



open the anterior ethmoidal cells, the frontal sinuses and the antrum of Highmore. The inferior meatus accommodates the opening of the nasal duct.

The septum is formed by the perpendicular plate of the ethmoid, the vomer, the crest of the nasal bones, the nasal spine of the frontal, the rostrum of the sphenoid, the crest of the superior maxillary and palate bones and the cartilage of the septum. The space between the anterior nares and the anterior edge of the cartilage of the septum, is filled by membrane, the columna nasi. The mucous membrane lining the cavity of the nose is called the Schneiderian



Fig. 4. Insertion of the transplant.



Fig. 5. Cases shown in figure 1 at end of operation.

membrane. It is continuous with that of the various sinuses, communicating with the nasal fossae, with the conjunctiva from the nasal duct and lachrymal canals, and with the pharyngeal mucous membrane through the posterior nares, and the skin of the face through the anterior nares. On the outer wall of the septum the mucous membrane is unappreciably divided into upper, olfactory, and lower, respiratory part; the olfactory part consists of the mucosa over the superior and outer part of the middle turbinate, the corresponding part of the septum and the roof of the nose; the balance is respiratory. The epithelium covering the surface consists of three varieties, stratified squamous near the nostrils, columnar in the olfactory region, and ciliated columnar in the respiratory region and sinuses.

The nose is supplied with blood by the sphenopalatine, branches of the descending palatine, and the

arteria septi nasi, from the facial. The organ receives its nerve supply from the olfactory, the nasal (first division of the fifth), nasal-palatine, nasal branch of the Vidian, nasal branch from the superior palatine, and from Meckel's ganglion.

Those points of moment to be considered in all nasal operations requiring grafting may be briefly enumerated as follows:

- (1) The source of the graft.
- (2) The nature of the graft—autograft, isograft or zoograft.
- (3) The bed for the graft.
- (4) The type of graft—bone or cartilage.

*Source of the Graft.* Autografts or grafts from other parts of the same individual are generally recognized as preferable whenever possible. In isografting, or grafting tissue from other individuals,



Fig. 6. Typical case of pachyrrhinia or broad, flat nose requiring the operation of rhinosyngiasis.

the health of the donor—absence of syphilis, tuberculosis, small-pox—must be assured, and success or failure will depend upon the similarity or dissimilarity of blood groups of host and donor. In zoografting, grafts have been taken from many species—the inner surface of the wing of the pullet, from pigeons, young puppies, guinea-pigs, rats, rabbits, frogs, the common lizard, cats, and even the lining membrane of the hen's egg and fetal membranes and parts.

*Nature of the Graft.* In this article special consideration is given only to the transplantation of bone and cartilage and the preparation of the surface to receive such grafts. In the operation I am about to describe, it is preferable to use autografts whenever available; when these are not available, use isografts, the preparation of which are later considered.

*The Bed for the Graft.* In autorhinometaplastie, the receiving surface must be of equal consideration to the autograft. This surface must be free from blood as nearly as possible and in an aseptic condition. Under favorable conditions all types of autografts may be placed on fresh wounds and be expected to "take". A non-take of a normal living



healthy autograft on a fresh wound, would in all probability be due to blood between the wound's surface and the inferior part of the autograft. Davis claims that "cartilage is an ideal supporting substance for transplantation when too much strain will not be placed upon it, and will live and not shrink when transplanted free (either with or without its perichondrium) into soft parts. It will also live when in contact with bone at one or both ends, although the union between bone and cartilage will not be rigid". This statement is at variance with the author's experience relative at least to nasal procedures.

*The Type of Graft.* In my work of constructive surgery of the nose I have used sections from ribs, costal cartilages, the sternum and tibia with but mediocre success. In those cases of cartilage transplantation, the transplant is usually absorbed—the



Fig. 7. Front and profile views of a case of pachryrhine before operation.

cartilage being non-vascular (dependent entirely for its nourishment on the perichondrium) is apparently without sufficient vital resistance. Another great disadvantage in the use of cartilage is the difficulty of thermal sterilization. Cartilage is composed of two individual entities—a mucoid material which comes from the exterior sheath of the cartilage cell, and is gelatinous. When cartilage is subjected to thermal sterilization, there is a divorce of these essential constituents. Seven or eight years ago, before I found that it was an absolute necessity for successful transplantation, and, to prevent severe reactions, to sterilize my transplants in this way, I had a few cases where I transplanted cartilages which did not suppurate, and where the nose still retains its shape; but such cases are so insufficient numerically in comparison to the unhappy absorptions, that their rarity but makes more precious their lesson.

In those cases in which I have used sections from the tibia, sternum and rib—barring the sometimes serious osseous complications which are of such common occurrence from the removal of bone in

these localities—I have found the compact outer plate too dense and hard to properly mould, and the graft frequently does not take, apparently rapidly losing its vitality.

In the past five years I have done this operation four hundred times using the middle turbinate as source of the graft. This bone is easy to shape and tolerates thermal sterilization without losing its vigor, and the results have been satisfying to my patients and gratifying to myself. At this juncture I would warn against using the inferior turbinate on account of its physiological importance. The



Fig. 8. Front and profile view of patient shown in figure 7, after operation.



Fig. 9. Saddle-back nose before and after operation. middle turbinate is of less moment, its only functions being to drain and act as a protection to the ethmoidal cells.

In the surgical therapeutics for saddle-back nose, and by that I refer to those depressions resulting from faulty operation on the septum and absorption of the cartilage following injury and congenital non-syphilitic deformities\*, I perform the following operation (rhinometathesis):

After rendering my field sterile and anesthetic as described in our articles on those subjects, (see figure 2) I use a pair of scissors to separate the middle turbinal bone from its insertion. This bone I remove intact with flat forceps. This part of the operation

\*First and second grade depressions. Third grade depressions will be dealt with in a future chapter.



must be done with all gentleness, for should the future transplant be injured or crushed in its removal, not only will it offer resistance to reestablishment of circulation and so become necrotic, but it will be also of less value when filling the depression. Now carefully guarding against injury to its periosteum, I clip off with scissors all the mucous membrane and shape the edges to make its surface a proper fit for its future bed. I now subject it to a thermal sterilization of 143° F. in normal saline solution for four minutes. It is next thrown into a bath of a similar solution and washed free of all collagenous matter and debris by an assistant while I further prepare its future resting place. This is done by an incision just within the nose running from behind forward parallel to that line where the lateral cartilage is inserted into the septum. The incision must be no wider than the breadth of the transplant. Through this incision I insert my knife and with care form a pocket under the periosteum of the nasal bones and along the edge of the triangular cartilage. (figure 3)

Into this surgically formed cavity the transplant is now inserted where it must fit with comfort and without compression. (figure 4)

The transplant now in situ, I apply 3% iodine to the edge of the wound, and pack the anterior nares with sterile cotton. Ice compresses are applied over the nose for twenty-four hours.

In isografting and zoografting, the same procedure should be followed as far as the character of the pouch, the type of graft, its preparation and the immediate technic are concerned, with of course, the precautionary measures I have already related under those heads.

Saddle-back noses usually present a flat appearance. In most depressed noses the nasal bones, together with the frontal processes of the superior maxillary bone, have been bent downward; in other words, flattened on the face, producing a broad, flat nose (pachyrhinie), (figure 6) and a mere transplant will not be sufficient to make a good appearing nose. To narrow the width (rhinosypsis), the frontal processes of the superior maxillary and nasal bones will have to be severed from the bed of the maxillary bone by sawing through the frontal process of the superior maxillary bone on each side and bending them inward. This will give the nose a higher appearance, and if on top of this is inserted the transplant, the nose will be in better shape. As all these flat noses have this wide base, the operation for transplantation will be as follows: instead of loosening all of the skin and periosteum over the whole nose and processes, I make three pockets. If

I made one pocket out of the whole operation, the transplant would not remain in its bed. It would shift to either one side or the other of the nose, but leaving the periosteum attached to the bone alongside of the middle pocket, this will be prevented.

Patients can leave their beds in twenty-four to forty-eight hours, and if the nose is not subjected to pressure or the transplant disturbed, only a slight reaction takes place.

### SARCOMA OF THE PROSTATE—REPORT OF A CASE.\*

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Sarcoma of the prostate is a disease worthy of report, because of its rarity. The case here recorded is the thirty-sixth of its kind found in the medical literature to date.

In 1839, the first case of sarcoma of the prostate was reported by Stafford. It was a melanotic tumor in a child five years of age.

Ewing states that sarcoma very rarely occurs in the prostate, and that many of the cases so diagnosed are of uncertain nature.

Kettle states that sarcoma of the prostate rarely occurs.

Thompson in 1858 found six cases of sarcoma of the prostate in the medical literature reported to that date.

Kaufman and Burckhardt both reported in 1902 that they were able to collect 24 cases of sarcoma of the prostate in medical literature to that date. Kaufman further states that of the twenty-four, three occurred in infancy, seven in the first decade, and only seven between the ages of 30 and 70 years.

Bland-Sutton quote Proust and Vian as having collected up to 1907 thirty-four case histories of sarcoma of the prostate, the youngest occurring in an infant five months old, the oldest in a man 73 years old. Of the cases reported, about 50% occurred in individuals under eight years of age.

Hugh Young, of Baltimore, in 1910 reported the thirty-fifth case, occurring in an adult, which was of the mixed cell type.

#### CASE HISTORY.

J. W., age 45, was first seen on November 6, 1920, complaining for one week of burning urination. For the preceding two years he had been disturbed with frequency of urination, every two hours daily,

\*Read before the Genito-Urinary Section of the New York Academy of Medicine, March 16, 1921



every three hours at night. To the above symptoms during the preceding year had been added urgency of urination. Aside from an attack of gonorrhea fifteen years before, his past history was negative. The family history bore no light on the etiology of the growth.

The patient was a fairly well nourished adult male, white, of a neurotic temperament. The eyes were clear, the pupils reacting to light and accommodation. Conjunctivae normal. The heart and lungs were entirely normal. Abdominal palpation, negative. Reflexes were slightly exaggerated, but not to an abnormal degree.



Fig. 1.

The external genitals were normal. Urethral smear showed an occasional pus cell and some colon bacilli. The urinary findings were normal. Prostatic smear was negative. Per rectum, the prostate gland was markedly enlarged, firm and regular. The enlargement involved the left lobe only. A tentative diagnosis of malignancy of the prostate was made, mainly from its consistency. An *x*-ray picture was then taken of the prostate with the bladder inflated with air. This showed (figure 1) a marked enlargement of the left lobe of the prostate, the catheter being deviated to the right, taking a peculiar curve through the prostatic urethra.

On November 13, 1920, cystoscopy was attempted but abandoned on account of the instrument meeting a marked obstruction in the prostatic urethra. Withdrawal of the instrument was accompanied by

a great deal of bleeding, which subsided in about twenty-four hours.

Two prophylactic *x*-ray treatments were administered before any surgical procedure was essayed. On November 29, 1920, the patient received his first *x*-ray treatment; two days later he received a second one. About twenty-four hours after the second *x*-ray treatment, he complained of vesical symptoms, consisting of tenesmus, accompanied by a severe hemorrhage per urethram. He was put to bed, and a retention catheter inserted. After a few days the bleeding subsided, and on December 13th, a supra-pubic cystotomy was performed. A tumor about the size of a hen's egg was found to involve the



Fig. 2.

left lobe of the prostate. This was enucleated without difficulty. The mucosa of the bladder was normal. There was some bleeding from the prostatic cavity after removal of the growth, which was immediately arrested by packing with gauze saturated with thrombo-plastin. The specimen removed was sent to the laboratory, and on December 26th, Dr. M. J. Fein reported that it was a spindle-cell sarcoma of the prostate (figures 2 and 3.)

Under the supervision of Dr. William H. Dieffenbach, the patient was given 840 milligram-hours of radium treatment (35 milligrams for 24 hours screened through a silver tube), the tube of radium being inserted per urethram into the prostatic cavity. Immediately after the radium treatment, the patient was apparently relieved of vesical irritation, of which he had been complaining since the operation, but it recurred about two weeks later.

On February 7, 1921, the patient died, and at autopsy the growth was found to have extended so as to involve the entire bladder mucosa, and the abdominal wall from the pubis to the umbilicus. The



growth had also extended back to the rectum where it had eroded through into its lumen.

#### COMMENT.

Because of the rarity of this disease, we feel that a few important and interesting facts should here be stated.

Of the 36 cases thus far reported, there have been 11 different types of sarcoma found. Most of the tumors have been found to occur during infancy and early childhood. Only eight of the growths were found in men over 58 years of age. The tumor itself very frequently has been found to grow to a considerable size, so as to completely fill the pelvis, forcing the bladder upward and forward; at times producing no residual urine, and at other times, when

tion and difficulty in bowel movement from pressure or extension into the rectum. In a few cases reported, urinary retention was the first symptom of the growth. Hematuria is very uncommon in this condition.

The question of treatment arises. McGowan reports a case in which the patient was apparently cured, but died four years later of cancer of the liver. This is the longest any patient has lived after the diagnosis was made.

In the case here reported, we note that although the patient had been given prophylactic *x*-ray treatment, though there was an apparent complete removal of the growth at operation, and the patient had received 840 milligram hours treatment with radium, yet within two months the growth, which at the time of operation was limited to the left lobe of the prostate, had extended so as to involve the entire bladder, rectum and abdominal wall.

Had a positive diagnosis been possible pre-operatively, more could have been accomplished by a simple cystotomy accompanied by *x*-ray and radium treatments, than by any known surgical procedure.

219 WEST 81ST STREET.

#### PRIMARY SARCOMA OF THE INTESTINES. A REVIEW OF RECORDED CASES.

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During the past year I studied the literature on sarcoma of the gastro-intestinal tract, including the gall-bladder, pancreas, and liver. In June, 1920, before the Pathological Society of Philadelphia, I reported a case of primary sarcoma of the appendix and reviewed the 16 cases on record in the literature. (*American Jour. Med. Sci.*, 1921).\*

I was able to find 130 cases of primary sarcoma of the small and large intestines, including the rectum. I collected 265 cases of primary sarcoma of stomach, including a few cases that I was able to collect from several surgeons and clinicians, that have not been reported. Fifty-nine cases of primary sarcoma of the liver, 21 cases of sarcoma of the esophagus, 65 of the tongue, 19 of the pancreas, and 16 cases of primary sarcoma of the gall-bladder were found in the literature.

\*G. H. Semken, on February 23, 1921, reported before the New York Surgical Society, a case of fibro-sarcoma of the appendix in a man. If this was a true primary sarcoma of the appendix, there are now 18 cases on record, including my own case.



Fig. 3.

there is pressure upon the prostatic urethra, much residual urine is present. In Young's case, 44 ounces of residual urine were obtained.

The consistency of the tumor may vary from that resembling an abscess, soft, and apparently fluctuating, to a consistency simulating the stony hardness of sarcoma of bone.

Sarcoma of the prostate may have occurred, and probably does occur, more frequently than medical literature indicates; for the symptoms in these cases vary a great deal, as most patients do not complain of any pain or difficulty in urination until urinary obstruction develops. Pain is very rarely complained of before the growth has already done its damage, as in our case. In some cases, the diagnosis is not made because the patient complains only of constipa-



A brief review of the literature on intestinal sarcoma may not be without interest.

#### PRIMARY SARCOMA OF THE SMALL INTESTINES.

E. A. Bjorkenheim, *Zentralbl. f. Gynäk*, October 5, 1921, No. 40, reported a case of primary sarcoma in the small intestine.

Douglas, *Ann. Surg.*, March 1912, LV., No. 3, reported a case of sarcoma of the small intestine. This will be mentioned again later.

R. Patek reported in the *Zentralblatt f. Gynäk*, March 22, 1913, No. 37, a case of primary sarcoma of the small intestine.

W. Wortmann, in *Deutsche Zeitschrift f. Chir.*, June, 1913, wrote on "Sarcoma of the Intestine" and reported a case.

R. W. Hammack, of Manila, wrote on primary sarcoma of the small intestines. His paper appears in the *Philippine Journal of Science*, April 8, 1913.

Hammack (1913) analyzes 3 cases of primary sarcoma of the small intestine. Of the types of sarcoma found, lymphosarcoma is the most frequent, but spindle-cell, round-cell, and melano-sarcomas as well as endotheliomas occur. The tumor most frequently occurs as a spreading, infiltrating growth completely or nearly encircling the intestine, but may occur as a polypoid mass projecting into the lumen. The growth is usually confined to the intestinal wall, leaving the serosa intact. Ulceration, on the other hand, is frequent and may cause perforation. It is remarkable, however, that very extensive infiltrations of the intestinal wall, including the mucosa, can take place without ulceration. Dilatation is more frequent than stenosis. This is apparently due to the widespread infiltration and destruction of the muscular coats with possibly the additional factor of accumulation of intestinal contents on account of the absence of peristalsis. The annular type of tumor, however, can cause constriction. When complete obstruction occurs, it is most often by direct extension from the metastatic growths in the lymph nodes. All of the cases presented by Hammack were lymphosarcomas, and all exemplified the annular form, while one showed the infrequent condition of stenosis. In all there have been metastatic growths in the abdominal lymph nodes with more or less widespread extension from these. In but 1 case, in which there was a small nodule in the heart, was there metastasis beyond the abdomen.

C. Williams, of Batterson, La., reported a case of sarcoma of the small intestine in the *New Orleans Med. and Surg. Jour.*, September, 1913, No. 3.

Morton (1916) reports 3 cases in his article. The first case showed a tumor composed of many hydatid

cysts growing within the abdomen, and protruding into an umbilical hernia so as to form a large pendulous growth. The second case was one of sarcoma of the small intestine, causing recurrent attacks of obstruction. The third case was a malignant growth of the colon, causing obstruction and was associated with phthisis in a man of 21.

C. Pavesio, in *Riforma Medica*, June 26, 1911, (Naples), writes on multiple sarcomas in the small intestine with report of a case. Goto reported on Intestinal Sarcoma in 1911. Lilley's case (*Lancet*, August 5, 1911), was a melanotic sarcoma of the liver, secondary to a melanotic sarcoma of the eye removed by operation ten years previously.

C. J. Miller's case of sarcoma of the intestine was complicated by invagination of the ileum. (*Surg. Gyn. and Obst.*, August, 1913, 17, No. 2).

John Speese, of Philadelphia reported a case of lymphosarcoma of the ileum in a man aged 50, and a myxosarcoma of the mesentery in a woman aged 57, (*Ann. of Surg.*, May, 1914, LIX, No. 5, p. 727-738). These patients were in the service of Dr. John B. Deaver of the University Hospital, Philadelphia.

Farr's case of primary sarcoma of the large intestine, I already mentioned, (*Ann. of Surgery*, Dec., 1913, LVIII No. 6), in another paper.

L. S. Mackid reports a case of sarcoma of the intestine in a child aged 7 years. (*Canadian Med. Assoc. Jour.*, April, 1916, VI, No. 4).

Graham (*Brit. Med. Jour.*, Vol. II: 801, 1916), reports a case of ileocecal intussusception in a boy aged 14 years, who was operated upon May 30, 1916, and again July 11, 1916, when an irreducible intussusception was found. At the second operation four inches of the ileum were excised. Section of the excised bowel showed the presence of small, round-celled sarcoma.

The thirteen cases (as mentioned in my article on gastric sarcoma) of undoubted *primary sarcoma of the stomach* operated upon at the Mayo clinic between 1908 and August, 1920, are briefly abstracted in Haggard's article on the subject. There are 8 men, 1 boy aged 16 years, and 4 women, in the series. This is the largest single series of cases of primary gastric sarcoma operated upon in any one institution.

*Peritoneum*, Malignant tumors of the peritoneum are very rarely primary. Sarcomata have been reported as commencing primarily in the peritoneum.

Tillmann in his discussion mentions (Munro) endotheliomata that arise from a proliferation of the endothelial cells of the lymphatic vessels and of the peritoneum itself.

Steel (1904 *Amer. Journ. Med. Sciences*) collected 96 cases of retroperitoneal sarcomata. He found one case in a baby under one year and another in a patient 80 years old. When a solid tumor is felt in the retroperitoneal space (as in the hypochondrium or the pelvic or iliac regions), and is



fairly firmly fixed, or immovable, and practically not shifted by respiration, primary or secondary sarcoma must be thought of.

In twenty solid retroperitoneal tumors, collected by Rogowski, he found sarcomatous growths in every one. They were nearly all encapsulated (those in early stage).

Marconi operated on one case with good results. He removed a huge prevertebral lymphosarcoma and resected a portion of the vena cava.

Munro (1910) in Keen's Surgery, p. 779, III, refers in his bibliography to the cases of sarcoma (retroperitoneal) and the articles published by Williams (1903), Steel (1904), Noble (1904), Naumann and Lundberg (1902), Marconi (1894), Jacobsthal (1903), Balloch (1904 and 1903), Douglas (1903), and Fiori (1904).

Webster, of Baltimore, (December 1920), discusses the relationship between leukosarcoma, lymphosarcoma and lymphatic leukemia. He cites one case beginning as a localized tumor of the chest developing a typical lymphatic leukemia after roentgen-ray treatment. The glands were enlarged all over the body, the liver and spleen descended below the costal margin. He believes that a localized lymphosarcoma may, under certain conditions, become generalized and with a blood picture of lymphatic leukemia may terminate as a leukosarcoma. He emphasizes the fact that a lymphosarcomatous tumor, regardless of its primary site, extends and spreads in a characteristic manner first by local infiltration and later by the blood stream to parenchymatous organs, lymph glands, bone marrow, etc.

Kemp (1910) says "sarcoma of the intestines is rather an infrequent disease, much less frequent than carcinoma". In the course of 12 years, 1882-1893, in the Vienna General Hospital, among 274 autopsies on sarcoma, only 3 were of the intestine, the ileum, cecum, and rectum. In 61 cases of lymphosarcoma examined post-mortem, 9 were of the intestines, 1 in the duodenum, 3 in the jejunum, 3 in the ileum, and 2 in the cecum. In Libman's cases, 15 were duodenal, 18 jejunal and ileal, 14 of the ileum, and 3 were of the entire small intestine. In Krueger's 37 cases, 16 were in the small intestine alone, and 16 were rectal sarcomata, next in frequency were the ileo-cecal tumors. Kemp believes sarcoma occurs as frequently in the small as in the large bowel, and lymphosarcoma preponderates in the small intestine. They do not produce stricture of the bowel, as mentioned above. Müller examined the post-mortem material in Bern and of 102 sarcomata only one was a sarcoma of the ileum (the only intestinal sarcoma).

In Prague, in 13,036 sections in 15 years, there were only 13 intestinal sarcomata; ileum 7, jejunum and ileum 3, cecum 3—all were lymphosarcomata.

Sarcoma of the large bowel is most frequent in the rectum.

Smoler mentions 13 cases involving the entire intestinal tract; 3 were in the ileo-cecal region.

Schmidt, Engstroem, Blauel have each reported 2 cases.

Nothnagel states he encountered two cases of sarcoma in the colon, one in the ascending and one in the descending colon; one was a lymphosarcoma.

Glinski reported a case in which the entire large

bowel was involved. Treves reported a case of primary melanosarcoma of the ileum. Strasburger (1894), collected 9 cases of melanosarcoma of the rectum. Jopson and White (1901) collected 22 cases of primary sarcoma of the colon, while Libman, of Mt. Sinai Hospital, N. Y., collected 59 sarcomata of the small intestine. In Libman's series, the youngest patient was 5 days old, the oldest was aged 70 years. Of 49 cases, 35 were males and 14 females; more than 50% of the cases occurred between the ages of 20 and 40 years.

Ablon (1898) found 10 cases of sarcoma of the intestine in children.

Vanderlinden (1899) and DeBuck, Ball, Heaton, reported melanosarcomata of the rectum. Rolleston states, "sarcoma of the vermiform appendix is very rare indeed", and mentions Warren's, Paterson's, and Glazebrook's cases.

Babes and Nanu (1897) reported a very large myosarcoma in the small intestine. Pic collected a number of cases of primary lymphosarcoma of the duodenum. Sarcomata of the intestine in the great majority of cases have their starting-point in the submucous layer of the bowel.

Madelung's case of intestinal sarcoma occurred in a boy of four. Horn's case was one of congenital sarcoma of the descending colon with intussusception of the intestine, ending in the death of an infant 3 days old.

E. Libman reports 5 cases of sarcoma of the small intestine from his own experience; in 3 of the cases the resemblance to appendicitis was remarkably close.

Nothnagel (1903) cites one case of lymphosarcoma of the jejunum in a woman aged 23 years. She was treated for tuberculosis of the peritoneum and intestine. She was sick a year and a half. The patient complained of diarrhea, and violent abdominal pain from the beginning of her illness. She was only slightly emaciated. Her hemoglobin (Fleischl) was 45%. Weichselbaum performed the autopsy and tedious operation. The work should be done as found numerous lymphosarcomatous masses in the seat of the tuberculous ulcerations that had become cicatrized. In some of the cicatrices, isolated little tumor nodules were found, either at the margin of the ulcer or at their base. The large bowel was normal.

Wood (Delafield and Prudden's Pathology, 11th edition), refers to Jopson and White's (1901) studies on the subject of sarcoma of the large bowel. He states that "sarcomata of the intestine are of occasional occurrence. They are rare in the large intestine, with the exception of the rectum".



Wilner (1899) reported a case of melanotic sarcoma in the small intestine, and Vander Veer and Keller (1917) reported on melanosarcoma of the rectum.

In discussing Eisenbrey's paper on intestinal lymphosarcoma, Libman emphasizes the clinical resemblance of these causes to appendicitis. Lymphosarcoma of the intestine, according to Eisenbrey and others, is the most common type of sarcoma of the bowel.

No case of sarcoma of the small intestine was observed in the Berlin Pathological Institute from 1859 to 1875. Baltzer states that 57.8% of the cases occur in the fourth decennium. VanHook and Kanavel (1910) refer to Libman's "extraordinary experience with the rare sarcomata of the small intestine", and his "extensive study of the literature of the subject".

Madelung, according to VanHook and Kanavel, did not find a single case of sarcoma of the splenic flexure of the colon in his search of the literature.

Abbe (1910) states that primary sarcoma of the rectum is very rare. The most frequent type of sarcoma found in the rectum is the melanoma. Schlesinger has described endotheliomata of the rectum. The growth develops from the endothelium of the dilated vessels present in hemorrhoids.

Gerster reported 2 cases of sarcoma of the intestinal tract—one duodenal and one jejunal.

Orth, in 1890, collected eleven cases of intestinal sarcoma, (3 small intestine, 4 large intestine, and 4 rectum).

Baltzer's very complete paper was published in 1892. He reports 3 cases and analyzes 11 cases from the literature.

Van Zwahlenberg collected 15 cases of resection of the bowel for sarcoma, and published the paper in the *Journal of the Am. Med. Ass.*, March 9, 1901. Jopson and White collected a total of 22 cases of sarcoma of the large intestine, including their own case. They include in their list the cases reported by Arnott (1874), Horn (1882), Debrunner (1883), Beck (1884), Debrunner's second case (1883), Lange (1886), Bouilly (1888), Orth (1890), Baracz (1891), Wharton, (female, 2 years old, 1894), Becker (1894), Wharton (male, aged 21 years), Abbe (1895), Levi (1895), Smoler (1898), Smoler (1898, second case), Blauel (1900, male, 33 years), Blauel (female, aged 66 years, 1900), Fisher (1901, male, 28 years), C. Van Zwahlenberg (1901, boy aged 5 years), Hofmokl (female, aged 24 years, lymphosarcoma of cecum), and Jopson and White (boy, aged 4 years).

Jopson and White's case was John C. aged 4 years.

The autopsy was performed 24 hours after death. Spleen not enlarged. The liver was greatly enlarged. Gall-bladder normal. The stomach, small intestine and suprarenal glands normal. The cecum and appendix infiltrated, especially along the mesenteric attachment, with a direct continuation of the growth. The retroperitoneal and mesenteric lymph glands enlarged.

According to Ablon, of 10 cases of sarcoma of the intestine studied by him, 2 were in the large bowel.

Fisher's case was a cecal sarcoma in a man aged 28 years. Patient had epistaxis, swelling and bleeding of the gums, and a purpuric rash.

Fagge's case (1881) was one of sarcoma of the end of the ileum and ileocecal valve. This patient had sarcoma of the skin.

Wharton's case (1894) was a female baby aged 2 years, with a round-cell sarcoma of the cecum. Wharton's other case was in a man aged 21 years, with a round-cell sarcoma of the cecum. Both cases presented symptoms resembling appendicitis, similar to Libman's cases of sarcoma of the small intestine. Jopson and White exclude the cases reported by Djemil-Pacha (1896), Perceval (1818), and Thorne (1872). Of their 22 cases, 12 were in males and 10 in females.

Horn's case (1882) in a young girl was a spindle-celled sarcoma of the descending colon; there was almost complete obstruction.

Djemil-Pacha's case (1896-7) was a sarcoma of the great omentum and transverse colon; the primary growth was probably in the omentum.

Perceval's case was probably a sarcomatous polyp of the colon. The report was published in the *Journ. Assoc. King's and Queen's Coll. Phys.*, Ireland, (Dublin 1818, ii, p. 125).

Libman's cases occurred in:

(1) A boy aged 12 years. Large growth in duodenum. Stomach and pancreas diffusely infiltrated. Liver normal. Omentum and mesentery infiltrated with neoplastic masses. The gall-bladder and liver also involved in the general lymphosarcomatosis.

(2) A 3½-year old child, with primary intestinal sarcoma with dilatation and very extensive metastases—peritoneum, spleen, pancreas, adrenals, kidney, liver and gall-bladder. The appendix 11 cm. long, the wall much thickened and infiltrated by new growth. The stomach wall whitish and thickened. In the ileum several very large tumor masses 7 x 8 cm. This was a lymphosarcoma.

(3) A patient 18 years old. Jejunum involved by lymphosarcoma. A perforation through the tumor mass. No metastases. The diagnosis clinically was



general peritonitis, probably due to perforation of appendix.

(4) A man aged 42 years. A large tumor of the ileum was found, at operation by Dr. Brewer. This was a spindle-celled sarcoma. There were no metastases. The case closely resembled acute appendicitis.

Schulz, (*Archiv. fuer Heilkunde*, XV, 193), noted several cases of lymphosarcoma of the liver, intestines, stomach and kidneys.

Libman gives a discussion of the differential diagnosis of sarcoma of the small intestine in his paper, and includes 52 references to the literature on intestinal sarcoma.

Fisher's two cases (1919) occurred in:

(1) A man aged 61, laborer; at operation a lymphosarcoma of the ileum was found. He died 10 months after operation, from probable recurrence associated with an acute hemorrhage.

(2) A woman aged 67 years. She had a large lymphosarcoma of the colon (ascending) and cholelithiasis. A two-stage operation was performed. She made a good operative recovery.

Ford (1900) states that primary sarcomas of the liver are exceedingly rare, and he mentions the cases of Horup, Lancereaux, Arnold, Windrath, Waring and von Kahlden. Ford's case was a man aged 65 years. He had ascites. A small round and spindle-celled tumor was found in the right lobe of the liver, 5 x 8 cm. in size. Pancreas, spleen, thyroid, heart and suprarenals normal. The stomach, intestines and rectum normal. The mesentery, omentum and peritoneum showed numerous secondary neoplastic nodules. The tumor in the liver was probably primary.

Harrigan's case (1918) was a hypernephroma of the falciform ligament of the liver.

Von Esmarch stated that in his clinic more than 60% of his sarcoma patients were syphilitic. Speese (1914) in his paper collected 74 cases of sarcoma of the small intestine, for which resection of the bowel was done; 14 of these were complicated by intussusception. Kasemyer found sarcoma as a cause in 26 cases of a total of 284 cases of intussusception collected by him. Boas collected 37 cases of sarcoma of the intestine; of these 16 occurred in the small intestine and 16 in the rectum. The appendix was affected in one case.

In Thévenot's case (June, 1919), and in one reported from Athens, the sarcomatous polyposis of the small intestine was secondary to a sarcoma in the mediastinum or rectum. In both the polyposis induced invagination.

Bull's case (February, 1919) was a huge retroperitoneal myxofibrochondro-sarcoma, followed by recovery after its removal. Patient had had abdominal pains as the first symptom 10 years before; 6 years later the tumor became palpable. It weighed 15.5 kg., (over 34 pounds) after removal. The man was aged 54 years, a machinist.

Battle's case, (April, 1920) of recurring sarcoma of the small intestine in a child 8 years old, was associated with intussusception. The growth was a round-cell sarcoma (Shattock). Coley's fluid was used in increasing doses. She was first seen in 1913. In July 1916 she was again operated upon. At this time a large mass involved the small intestine about 6 inches from the cecum. Seven years after the beginning of her abdominal trouble she appeared in good health.

Vander Veer and Kellert's case (July, 1917) of melanotic sarcoma of the small intestine occurred as a primary growth in the ileum. The patient was a woman aged 50 years. She had a cough which was thought to be tuberculous in origin. She then coughed (1915) up some tissue, which upon examination was found to be possibly sarcomatous. She had pain for 4 or 5 weeks in left hypochondrium before coming to the hospital. She had an attack of acute intestinal obstruction, due to intussusception in the middle section of the ileum. Six inches of small intestine was resected. Holmes reported the tumor as a primary melanosarcoma of the intestine.

Douglas (1912) reviewed the collected cases of sarcoma of the small intestine.

Mayo (November, 1916) stated "carcinoma (primary) of the ileum is a very rare condition"; primary ileal sarcoma is even rarer. There are only about 8 recorded cases of primary carcinoma of the ileum.

Vander Veer states this condition is "most rare." In tumors of the intestine, the ileum is the most frequent site of the tumor, next the jejunum, then the ileo-cecal region, and lastly the duodeno-jejunal junction.

Berghausen (April, 1920) reports a case in a 40-year old man with positive Wassermann reaction, who had abdominal lymphosarcomatosis. Anti-luetic treatment did not do any good. The patient died soon after operation. Berghausen's second case occurred in a man aged 47 years. There was a strong family history of tuberculosis. The Wassermann reaction was strongly positive. He was emaciated and died of internal hemorrhage about a year and a half after the beginning of the illness. The liver and stomach were involved, as were also the mesenteric, retroperitoneal, and mediastinal lymph nodes, by the gen-



eral lymphosarcomatosis. The spleen, lungs and the right tonsil were involved in the tumor process. A huge sarcomatous mass was adherent to the transverse colon, both the flexures, the stomach and spleen. Aortitis (syphilitic) was present.

MacConnell (1883) before the Pathological Society of Philadelphia reported a case of sarcoma of the rectum, in a man aged 40 years. It was a small spindle-celled sarcoma. The man's illness was of several years' duration. The growth weighed from one to one and a half pounds.

Robert's case (March, 1884) in a woman aged 58 years, who had been ailing for 4 years, may have been one of sarcomatosis affecting the omentum, mesentery, peritoneum, rectum and intestine. Although it was probably shown as a carcinoma—only "malignant disease" was mentioned.

Mitchell's case (1885) of "encephaloid disease of the stomach" may have been a sarcoma; there were 16 pints of clear yellow fluid in the abdominal cavity. The omentum was very hard and covered with nodules, and the mass was adherent to the intestines and the stomach. It looked like a diffuse carcinoma. Henry, however, found no cancer cells. W. A. Edwards thought the nodular omental masses might, on microscopic examination, throw some light on the case. The man was a teamster, aged 63 years.

J. H. Muser (September 11, 1884), reported before the Pathological Society of Philadelphia a case of secondary sarcoma of the liver and ovary from a primary growth in the skin, in a woman aged 28 years. Spleen enlarged to twice its normal size. Inguinal glands matted together and enlarged. No mention made of the stomach and intestines. It was an alveolar sarcoma, (Formad).

James Tyson's case (February, 1885) was one of sarcoma of the retroperitoneal glands in a man aged 43 years.

Carl Seiler (September 27, 1883) reported a case of general melanosis—melanotic nodules were present in the liver, brain, skin, etc. A congenital nevus was removed from the scapula a half year before his death.

Edwards reported (November 9, 1882) before the Pathological Society of Philadelphia a case of large spindle-celled sarcoma of the small intestine in a woman aged 48 years. The growth sprang primarily from the submucous tissue of the small intestine, and grew with great rapidity. Edwards stated that the small intestine is an unusual site for sarcoma, and he was unable to find another instance of its occurrence in this situation. No secondary deposits were found at operation. No autopsy was permitted.

Gaucher (*La France Medicale*, No. 37, 1883) records a unique case of primary diffuse sarcomatous disease of the entire peritoneum, with autopsy. It was a globulo-cellular sarcoma. The lungs were normal; no neoplastic nodules were found in any viscus, nor any enlarged glands.

Norman Moore's case (1883) occurred in a woman aged 41 years. The lumbar glands were greatly enlarged. The duodenal wall was invaded by the growth and thickened, and the mucous membrane was ulcerated. No other organs were involved by the lymphosarcoma. The patient was sick 8 months. This was a primary lymphosarcoma of the duodenum, if the lumbar and mesenteric glands can be excluded as the primary seat.

Molson and MacDonald (May, 1882) reported a sarcoma of the jejunum in a plasterer aged 41 years. He had general dropsy. Autopsy by Osler. It was an enormous growth involving about 18 inches of the jejunum. The walls of the gut were infiltrated with the neoplasm, being in places 6 to 8 inches in thickness. There were numerous secondary nodules in the kidneys. Osler thought it was a primary large round sarcoma of the jejunum with metastases in the kidneys.

Hulbert (February 28, 1885) reported before the St. Louis Medical Society a case of a very malignant (Bremer) small, round-cell sarcoma of the intestine. A large part of the small intestines, the descending colon, kidneys, spleen and mesenteric glands were involved. The patient was a woman, aged 35 years.

Douglas (1912) reported a case of lymphosarcoma in a Turk aged 20 years. He was admitted to the Bellevue Hospital on July 1, 1911. Douglas mentions Moynihan's collection of 40 cases of sarcoma of the small intestine submitted to operation up to 1906, and of Lecène (1907) who includes an analysis of 89 cases, operative and non-operative. Additional cases have been reported by Goebel, Stern, Anderson, Endmann, McGlinn, Barling, Bondareff (2 cases, 1908), Leroy, Munk (6 cases of small intestinal sarcoma and one of splenic flexure), Fletcher (1909), and Scudder (lymphosarcoma of small intestine, with resections).

(To be continued)

#### GASTROSTOMY AND COLOSTOMY.

Colostomy and gastrostomy for inoperable cancer are legitimate operations; but their nature should be explained to the patient himself, if his mind is clear, and he should be allowed the opportunity to decide whether or not he will accept what the surgeon can give him in exchange for what he takes away.



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, AUGUST, 1921.

## SYPHILIS AND SARCOMA OF THE BONE.

It sometimes happens that bone syphilis is mistaken, by the surgeon or by the roentgenographer, for sarcoma. This mistake which, uncorrected, is disastrous to the patient, arises in cases of luetic periostitis or osteo-periostitis or in case of osteal gumma, especially when, as occasionally happens, it produces a pathological fracture. The error is, of course, most apt to arise in cases where the Wassermann reaction is negative, as sometimes happens in these late manifestations of the disease. In Eric Lexer's "General Surgery" (Bevan's American edition, 1908) occurred the statement that "roentgen-ray pictures reveal nothing characteristic" in bone syphilis. Nothing in medicine could be much further from the truth. The roentgen appearances in syphilis of the bone are usually quite characteristic and in most cases the diagnosis can be made unequivocally by this means, even in the face of a negative Wassermann reaction. To be sure, in some cases of chronic osteo-periostitis the roentgenographer may not be able to state whether the lesion is of pyogenic or luetic origin, sometimes in joint affections the roentgen findings may not be wholly determining, occasionally in infantile dactylitis the picture may show borderline conditions of doubtful interpretation, rather than the x-ray characteristics that distinguish syphilis from

tuberculosis. But even in these conditions doubtful roentgen findings are the exception; and certainly there should be no doubt in the roentgen differentiation between syphilis and neoplasm of the bones.

A gumma of the bone appears in the x-ray film as an area of bone absorption. But there its resemblance to a central sarcoma ends. Even when the disease involves the corticalis sufficiently to cause a pathological fracture, it does not produce *expansion of the bone* and *eggshell-like thinning out of the corticalis* as does the central sarcoma. On the contrary, the gumma is surrounded by an area of much *increased bone density*, clearly visible in the film. There will also be seen in the picture, usually if not always, the evidence of a *periostitis*. This, by its very presence as well as by its characteristics, excludes sarcoma, for central sarcoma is not accompanied by periostitis, and central and periosteal sarcomata are not found together.

Moreover, there is little resemblance between the x-ray shadows of luetic periostitis and those of periosteal sarcoma. In syphilis the periostitis is often circumferential; it may be circumscribed or scattered but often it covers much or all of the length of the bone; it may be of irregular thickness; but the shadow or shadows are often dense and are *sharply outlined* and *extend along the shadow of the bone* itself. In periosteal sarcoma, on the other hand, the shadows are *not sharply outlined*, they are *not dense in their periphery*, where they *fade out* in the surrounding tumor (which itself appears more or less faintly in the picture) and they *do not hug the bone*; on the contrary, they are *blotchy, wavy or fringe-like* and may appear to radiate from the bone in images that suggest a resemblance to swirls of sand in a storm.

## ORTHOPEDIC ISSUE

The next (September) number of the JOURNAL will be a special issue devoted to Orthopedic Surgery. It is to contain the following articles:—The Treatment of Joint Tuberculosis, by Leonard W. Ely, San Francisco; Operative Correction of Long-standing Erb's Palsy, by James Warren Sever, Boston; The Free Transplantation of Tendons, by Leo Mayer, New York; The Use of Tendon Implantation for Paralytic Deformities, by W. Edward Gallie, Toronto; Bow-legs, by Wallace Blanchard, Chicago; Scoliosis, by Samuel Kleinberg, New York; Hemorrhagic Osteomyelitis, by George Barrie, New York; Contractures Following War Wounds, by André Leri, Paris; Operative Treatment of Osteoarthritis of the Hip, by Fred. H. Albee, New York; Use of the Ordinary Wood



Screw in Certain Fractures of the Neck of the Femur, by T. Turner Thomas, Philadelphia.

### WALLACE C. ABBOTT

Dr. Wallace C. Abbott of Chicago who died on July 4th, was a picturesque figure, and a highly useful member of the American medical profession, in which he was widely known—both as editor-in-chief of *The American Journal of Clinical Medicine*, and as founder and president of the Abbott Laboratories (formerly the Abbott Alkaloidal Company). Unquestionably, his preparations of accurate alkaloidal extracts and his unceasing preachments concerning their use, profoundly affected the therapeutics of thousands of practitioners, while his more recent activities in manufacturing here many synthetic drugs formerly controlled by German houses, and many other scientific preparations for surgical and for medicinal use, have constituted a notable contribution to American pharmacology and American trade. In all his affairs his enthusiasm was boundless and his energy tireless. He probably sacrificed several years from his life by his ceaseless work. He will be missed by the associates and friends who drew inspiration from his dynamic personality.

## Progress in Surgery

Selections from Recent Literature

H. Lyons Hunt, M.D., L.R.C.S. (Edin.),  
Abstract Editor.

### A Critical Analysis of Twenty-One Years' Experience with Cesarean Section. J. WHITRIDGE WILLIAMS, Baltimore, Md., *Bulletin of The Johns Hopkins Hospital*, June, 1921.

1. This analysis is based upon 183 Cesarean sections performed up to December 31, 1920.
2. The operations were done in a series of approximately 20,000 deliveries, and comprise 104 single, and 79 repeated sections. The latter were done upon 41 women, 34 of whom had two, and 7 three sections each.
3. Although the number of white and black patients in the service was approximately identical, many more Cesarean sections were done upon the latter—114 to 69, while 30 to 11 required repeated sections.
4. The following types of operation were done:
  - 121 typical conservative sections,
  - 4 extraperitoneal sections,
  - 1 post-mortem section,
  - 57 Porro sections,
5. The gross mortality was 5.46% but, upon deducting cases in which death was not attributable to the operation, the net mortality was 3.45%; or 4.07% in the conservative and 1.82% in the Porro sections. All deaths, except one from hemorrhage, were due to infection.
6. The mortality was 13 times greater in the first 50 than in the last 133 cases—10 to 0.77%. This remarkable diminution was not due to changes in operative technique, but to the avoidance of ascending infection by operating before the onset, or during, the first hours of labor.
7. The conservative section late in labor is always dangerous, even if vaginal examinations have not been made; while the Porro section is relatively safe. The most important means of lowering the mortality of conservative Cesarean section due to disproportion is by learning to determine before the onset of labor whether the operation will be required or not.

8. The Porro operation is relatively safe even in infected or exhausted patients, as the absence of the involuting uterus hinders the spread of infection.

9. Disproportion due to contracted pelvis was the indication for interference in nine-tenths of the black, and in six-tenths of the white patients.

10. The several varieties of rachitic pelvis afforded the predominant indication in the blacks, as compared with the simple flat pelvis in the whites.

11. The most frequent non-pelvic indications were eclampsia, and serious cardiac decompensation.

12. Cesarean section is not the ideal treatment for eclampsia, and is indicated only in the rare instances in which the cervix is rigid and undilated and venesection has not led to improvement.

13. It is likewise only rarely indicated in placenta previa. But one section was done in 66 cases, and insertion of the rubber balloon is regarded as the best treatment.

14. Generally speaking, the patient should be sterilized at the third section, either by amputating the uterus or by an operation upon the tubes.

15. Abdominal incisions are made below the umbilicus, as this permits amputation of the uterus or operations upon the appendages, when necessary, without extending the incision.

16. The uterus should be incised in situ, and eviscerated before incision only in the presence of infection. Experience indicates that in normal cases the latter procedure increases the incidence of infection.

17. The uterine incision should be sutured in layers, and the greatest care taken to insure the closest approximation of the peritoneal margins.

18. The uterine cicatrix ruptured once in 48 women with repeated sections, as well as in 12 deliveries through the natural passages subsequent to section. The frequency of its occurrence is probably exaggerated so that the dictum "once a Cesarean always a Cesarean" is not necessarily correct. On the other hand, the possibility of rupture must always be faced and it constitutes the strongest argument against the unnecessary employment of Cesarean section for non-pelvic indications.

19. The placenta was inserted upon the anterior wall of the uterus in two out of every five cases. Consequently it is frequently involved in the uterine incision. This has no other significance than a momentary gush of blood.

20. The delivery of an asphyxiated child occurs less frequently than is generally believed. Somewhat over one-half of the children cried immediately after delivery, and only 7 per cent. were deeply asphyxiated.

21. Notwithstanding the extraordinary value of pituitary extract in stimulating uterine contraction, pronounced atony with danger of death from hemorrhage is still to be reckoned with, and necessitated amputation of the uterus in two of the patients.

22. Uterine adhesions were absent in one-quarter of the repeated sections, and were extensive in one-third of them. They are not necessarily the result of infection, as the puerperium was normal in 36 per cent. of the cases in which they developed. In many instances they appear to be associated with imperfect approximation of the uterine wound or with other traumatic factors.

23. The old superstition that boys originate from the right and girls from the left ovary can be definitely discarded. In two-thirds of the patients the corpus luteum persisted until the end of pregnancy, and its location bore no relation to the sex of the child.

24. Finally, it should be remembered that Cesarean section is not devoid of danger, and is relatively safe only when done under appropriate conditions before the onset or during the first hours of labor.

As the uterine cicatrix constitutes a locus minoris resistentiae in subsequent pregnancies Cesarean section for other than pelvic indications should be performed only when absolutely necessary. It is the writer's conviction that the operation is being abused throughout the country, and if accurate statistics as to its results were available that it would be found to be accountable for many unnecessary maternal deaths. It should be recognized that, although it is frequently the easiest manner of delivering the patient in the



presence of various abnormalities, it is not always the safest, and that ideal results are obtained in only a few clinics.

**Repeated Cesarean Section.** PAUL TITUS, Pittsburgh, Pa., *The American Journal of Obstetrics and Gynecology*, May, 1921.

A detailed account of the clinical history of 16 cases is given. They are divided into two groups,—the first consisting of ten patients whose first and second operations were the classical Cesarean section, the second comprising three women whose first operation was an extraperitoneal Cesarean section, while the second was a classical. Their fields are quite definite and must not overlap. There are, however, many cases which do not fall into either category. A woman might have been examined vaginally several times, or it might have been desirable to give a patient a prolonged test of labor if her pelvis were only moderately contracted, or there might have been one or two attempts at the artificial delivery of a patient, all of which would increase the likelihood of contamination and infection, and render the classical Cesarean section distinctly dangerous. The safety limits of the classical operation are sharply drawn. In the cases cited, suprasymphyseal and transperitoneal Cesarean section, done according to the technic of Frank has been chosen wherever contamination if not actual infection was suspected. This or the Kroenig-Gellhorn operation is employed in all patients who have been in labor any considerable length of time, even though no vaginal examinations have been made. Summarizing, the author states:

1. The method of Cesarean section to be employed in a given case depends upon the conditions and circumstances surrounding the case. The choice may be made between the classical conservative Cesarean, the low cervical Cesarean of Kroenig-Gellhorn, the extraperitoneal Cesarean of Frank and the Porro Cesarean section.

2. Good results follow the performance of Cesarean section either before labor has begun, or soon after its commencement.

3. Repeated Cesarean section is a comparatively safe operation if done under proper circumstances, both maternal and fetal mortality being low.

4. There seems to be a definite relationship between the occurrence of fever during the puerperium and the formation of abdominal adhesions.

5. "Test of labor" is often followed by a febrile puerperium.

6. Adhesion formation between the uterus and the abdominal wound occurred in each of the three cases in this series in whom the low abdominal incision was employed. Results in this respect from the high incision of Davis for classical Cesarean section are greatly superior.

7. Careful coaptation of the edges of the uterine wound, from the endometrium out, will, in the absence of infection, insure a firm, thick union, in which there is a tendency to muscle regeneration.

8. Rupture of the uterus is a possibility in each repeated pregnancy, but is unusual unless there has been infection in the puerperium of a preceding pregnancy.

9. Extraperitoneal Cesarean section is the operation of choice when contamination or infection is suspected. The anatomic distortion following this operation is not great, although quite definite.

10. Sterilization of a patient is inadvisable at the first Cesarean section unless some special reason exists for it.

11. Sterilization after repeated Cesarean section must depend upon the needs, pathologic and otherwise, of the individual case.

12. Mere ligation of the tubes is not sufficient for sterilization. A portion should be resected and the stumps buried to insure success.

**Surgical Procedures in Fractures of the Elbow.** JAMES G. OMELVENA, Norfolk, Va., *Virginia Medical Monthly*, June, 1921.

After taking up the anatomy and the fundamentals of the various fractures of the elbow-joint, the writer lays stress on the technic of maintaining reduction. With the x-ray plates to assist, and the patient anesthetized, the patient's arm is grasped at the seat of the fracture with one hand, the forearm is grasped close to the elbow with the other, an assistant making needed traction on the forearm. When the

fragments seem normally approximated by retraction, the forearm is acutely flexed on the arm and retained by a wide strip of adhesive stretching across from just above the wrist to just below the axilla. A wide binder is applied to hold the arm to the chest wall. A smooth pad should be placed in the crook of the elbow and the arm, forearm and hand protected from the chest wall by suitably placed pads. The pulse at the wrist and the amount of swelling determine the acuteness of the flexion. An x-ray picture is then made to be sure that reduction is maintained. The flexion is increased as the swelling subsides. One of the chief dangers of elbow injuries is the loss of elbow flexion. Dressing the elbow in acute flexion avoids this. The dressings are removed in ten days.

**Present Status of the Treatment of Operable Cancer of the Cervix.** W. P. GRAVES, Boston, Mass., *Surgery, Gynecology and Obstetrics*, June, 1921.

Graves comments upon the favorable results of operation when done by skillful surgeons, and mentions Dr. Cobb's startling reports on 60 operations. The value of radium as a palliative agent is accepted. The problem now is whether radium should be used in frankly operable cases—as is openly advocated by those working in large radium centers.

"Conclusions drawn from our personal results must be made guardedly. It may be said that we have not—so far as we know—cured with radium a single case of inoperable cancer of the cervix. It is to be noted however, that this statement is the result of individual experience. It is not equivalent to saying that inoperable cancer of the cervix cannot be cured by radium, for there is evidence to the contrary. . . . In view of the greater success attained in other clinics than our own, it is also within the range of possibility that some of our own cases now in the so-called 'clinically cured' stage may ultimately prove to have been permanently cured."

In view of the author's unfavorable experiences with radium, and his very favorable operative results, of which he gives statistics, he does not feel justified in substituting radium for radical surgery in cases favorable for operation.

Whatever the ultimate treatment of cancer of the cervix shall be, the general outlook is encouraging, due to the fact of the increased education on the part of the laity and the general practitioner, as a result of which cases are being detected at an earlier stage than formerly.

G. S. REITTER.

**Cancer of the Breast.** MILES F. PORTER, Fort Wayne, Ind., *The Journal of the Indiana State Medical Association*, June 15, 1921.

All tumors of the breast should be regarded as malignant until it is proven that they are benign. Properly administered, x-ray treatment is beneficial and should be resorted to more generally than it is. It is well for the surgeon not to become too attached to any particular plan, but to make himself master of the whole situation and then adopt that operation best suited to the case in hand.

Certain cardinal principles should be remembered:

1. No sacrifice in the way of time, cosmetic results, or utility is too great to make for the cure of the patient, but unnecessary mutilation should be avoided.

2. Properly planned incisions with undermining of the skin and at times mobilizing of the opposite breast will make it possible to close nearly all of these wounds.

3. The posterior thoracic nerve should be preserved.

4. The flap lining the axillary space should be held snugly in the apex by stitches or dressing to avoid subsequent inability to elevate the arm.

5. Careful and complete hemostasis adds to the safety, comfort and convenience of the patient and will frequently do away with the necessity for drainage and allow healing of the wound under the primary dressing.

6. Early use of the arm should be encouraged.

**The Treatment of Cancer.** FREDERICK BRYANT, Worcester, Mass., *The Boston Medical and Surgical Journal*, June 16, 1921.

Certain known facts are extant regarding cancer. (1) It is neither hereditary, infectious, contagious or communicable. (2) There is an age of greatest susceptibility. (3) The exciting cause is some form of chronic stimulative irritation. (4) Cancer is at first local or regional, and if thoroughly removed while in its incipency will not return.



(5) Cancer in different parts of the body has come to be regarded as an almost different disease, requiring different treatment, and entailing different prognosis. (6) There is much evidence that certain constitutional predispositions aid and abet the local exciting cause. (7) Cancer increase keeps pace with modern civilization and is more common in the city than in the country. (8) Radiant energy of heat, roentgen rays and radium have a destructive and selectively destructive effect on the cancer cell. Not only early operative measures, but combining surgical therapeutics with radio-therapeutics and all the agencies which have proved therapeutically effectual, is recommended.

**The Present Position of Radium in the Study and Treatment of Uterine Cancer.** WILLIAM S. STONE, New York, N. Y. *Surgery, Gynecology and Obstetrics*, June, 1921.

Stone states that in the uterus is found the same kind of response of tumor tissue to radiation as in other parts of the body. The embryonal and rapidly growing types are regularly the most responsive: the glandular type more so than the epithelial, and the papillary and less infiltrating type more so than the deeply infiltrating variety. In cervical cases, certain types have been observed—a few cases that correspond to the basal-celled type of epithelioma, and also the so-called plexiform type which is essentially a papillary type and in which lymphnode invasion is late. Both these types are especially susceptible to radium.

From the author's observations in over 400 cases of uterine cancer treated with radium, he offers the present therapeutic position of this agent as follows:

In all recurrences radium produces better results than operation, provided they are not too far advanced and are not so closely related to the bladder or rectum that fistulae or functional disorders will result. Even when the advanced stage precludes the idea of a considerable regression, pain may be relieved, hemorrhage stopped and the progress of the growth materially checked by one carefully adjusted dose. Occasionally cross-firing may be done, either with radium or the x-ray.

For all cases of primary uterine cancer, with few exceptions, radium should be regarded as the method of choice.

The so-called borderland cases have become a subject of frequent discussion, but radium has here demonstrated its remarkable value. Its use as an adjunct to operation—instead of a substitute—is to be discouraged. As a prophylactic measure in early cases, its use should be encouraged.

In cases of the cauliflower type, in which there is a bulky necrotic tumor and the cautery is deemed advisable—or has been used—it is best not to follow this with radium.

In cancer of the body of the uterus, the application of radium 1 or 2 weeks prior to operation will materially improve the results that have hitherto been obtained by operation alone.

On account of lymph-node involvement in certain cases of cancer of the cervix, radium cannot entirely supplant the operation in all of such early lesions.

The question of the comparative effects on tumors of large doses for short periods and small doses over longer periods has not been definitely settled and a plea is made for more data on this aspect of treatment. The chief error in the use of radium seems to be in overdosage, with the subsequent disastrous results to the neighboring tissues. A strong plea is made to avoid treatment of primary cases that are too far advanced.

G. S. REITTER.

**Treatment of Gastric and Duodenal Ulcers With Radium.** F. E. PARKE, Stoneham, Mass. *Medical Review of Reviews*, June, 1921

The author states that one of the accepted facts about radium is the power it has of increasing cell metabolism when used in the proper dosage. With this idea in mind, Parke undertook to treat ulcers of the intestinal tract with radium.

He reports 5 cases of gastric and duodenal ulcers, all of which have had uniformly good results. All of the cases were chronic and severe. Some had had hemorrhage and had been operated upon. In all, the pain and hemorrhage ceased promptly. In one, the patient, has been well for 6 years.

The method used was as follows:

(a) Rectal feeding until all pain had disappeared from the stomach from a week to ten days, then gradual resumption of stomach feeding, beginning with soft solids.

(b) The constant application over the site of the ulcer of a pad of about 10 microgrammes of radium element.

(c) Four ounces of freshly prepared radium emanation water every 2 hours through the day by the mouth.

(d) 20 c.c. of radio-active sea-water, after the method of Rene Quinton, injected subcutaneously every other day. There was very little discomfort experienced from the withholding of food and the treatment through the whole period was easily bearable.

G. S. REITTER.

**Further Clinical Studies on the Use of Mercurochrome as a General Germicide.** HUGH H. YOUNG, EDWIN C. WHITE, and ERNEST O. SWARTZ, Baltimore, Md., *Journal of the A. M. A.*, July 9, 1921.

Since the publication in 1919 of the preliminary laboratory and clinical study of "mercurochrome-220," this compound has been used extensively in many urologic conditions in the Brady Urological Institute and in other genito-urinary and gynecologic services and dispensaries. The satisfactory results in urologic practice have led to its application in other branches of medicine and surgery in which a deeply penetrating, non-irritating germicide of low toxicity and relatively quick action is desired. As a result of the authors' experience with this drug over a period of two years, early expectations of its great value have been realized. In many cases it has proved effective when other drugs have failed, and there have been cases in which the reverse was true. It is no more a panacea for all urinary infections than is any other disinfecting agent, but it is unquestionably a valuable addition to the comparatively few powerfully germicidal substances which can be applied to sensitive surfaces such as the mucosa. Solutions of from 0.25 to 0.5 are sufficiently concentrated to produce a satisfactory germicidal effect in the urethra and are always non-irritating. Emphasis should be laid on the desirability of using fresh solutions; the solutions deteriorate on standing. In spite of the high test tube germicidal activity of these solutions, the results obtained by local use of these solutions in acute gonorrhea have not been vastly superior to those obtained by the intelligent use of argyrol or acriflavine. The introduction of the water-soluble sodium salt and the abandonment of the use of the alkali-soluble form of the drug is responsible for a diminution in the amount of irritation produced by these solutions.

The authors conclude:

1. Mercurochrome has proved to be a very valuable drug in acute gonorrhea, but the intense stain is a drawback to its use as an injection by the patient. Acriflavine is free from this objection and, although not so good a germicide, is often preferable in acute cases.

2. In chronic infections of the urethra, prostate and vesicles the great value of mercurochrome has been amply proved. It penetrates deeply and may be found in the prostatic secretion several days after posterior instillation.

3. The results obtained in many cases of chronic cystitis are remarkable, long standing infections often clearing up in a few treatments. In some cases which fail to become sterile, constant reinfection of the bladder is found to occur from kidneys or prostate.

4. Mercurochrome is less irritating and produces less reaction in the renal pelvis than silver nitrate solutions, while possessing about equal germicidal powers; but in some cases both drugs should be used alternately, and sometimes silver is better.

5. In some cases of pyelitis, the infection comes from the teeth, tonsils, etc., and sterilization of the pelvis is impossible until the primary focus is cured.

6. Continued use has proved it to be a most satisfactory dressing for venereal ulcerations and buboes.

7. In general surgery, reports indicate that mercurochrome is very valuable in dressing open wounds and sinuses.

8. The germicidal efficiency of the drug in other branches of medicine and surgery has been proved, especially in the treatment of infections of the throat, nose, sinuses, ear and eye and teeth. It is reported to be most efficient in disinfecting the throats of diphtheria carriers.



**Singultus.** HARRY SCHULTZ DE BRUN, New York, N. Y., *New York Medical Journal*, June 1, 1921.

Hiccough is as important to the surgeon as to the medical man, and as a symptom has been sadly neglected. The subject is classified into (1) simple—due to sudden changes in temperature and transient in character; (2) inflammatory, coming on after an onset of certain inflammatory diseases of the abdominal viscera as gastritis, appendicitis, enterocolitis, suppurative hepatitis, period of discharge, pancreatitis, strangulated hernias, typhoid and cholera, and when inflammation affects the phrenic nerve or there is general nerve debility; (3) irritative, due to acute indigestion or dilatation of the stomach, certain foods, drugs, worms, and to post-operative conditions. The irritative type often occurs in abdominal and chest tumors and in associated gynecological maladies; (4) traumatic, a type seen frequently in the war, following gun-shot wounds of the neck, chest and upper abdomen where the pneumo-gastrics or phrenics have been directly or indirectly injured; (5) specific—as in nephritis, malaria, gout, diabetes, and acute rheumatic fever; (6) neurotic and idiopathic.

The writer after citing some 23 various treatments for the different forms, concludes:

1. Singultus has been known to be the sole cause of death.

2. The symptoms may be classified as to cause: (a) simple; (b) inflammatory; (c) irritative; (d) traumatic; (e) specific; (f) neurotic; (g) unknown origin.

3. Attacks last from one minute to several months, with or without spasms, during sleep, and with or without remissions.

4. If the condition of the patient permits, always treat the causative factor when found.

5. If physiomechanical and medicinal treatment fails, resort to narcotics and anesthetics.

**Infective Arthritis and Allied Conditions.** W. H. WILCOX, London, *The British Medical Journal*, June 4, 1921.

Among the etiological factors, sex, age, race, family history, mental stress and debility, trauma and physical stress, exposure to cold, pregnancy and parturition as well as faulty metabolism, rheumatic fever, and infective diseases are all considered from an etiological or causative standpoint. The commonest cause of infection is found to be in connection with teeth sockets. A septic condition of the tonsils, intestinal infections, constitute another leading causative factor. The author, after having discussed these causative factors, morbid anatomy, symptoms and physical signs, states that a careful and complete physical examination should be made in each case to find out any possible source of infection. This should be supplemented by an x-ray examination of the teeth, and bacteriological examination of the stools and urine. In pyrexial cases, absolute rest, electric light baths, fomentations, iodine poultices, intestinal antiseptics, among which "dimol," a new antiseptic having 15 times the disinfecting power of phenol are said to be non-toxic in 2 to 4 grains in keratin capsules three times daily, are recommended. Bier's treatment for twenty minutes daily is of value.

In non-pyrexial cases iodine is of particular value. The source of infection as soon as found should be eradicated and be followed by vaccine treatment. In chronic and sub-acute cases, electric light or radiant heat treatment should be given daily, and followed by ionization with iodine ions, a two per cent. solution of lithium iodide being placed on the lint of the kathode. Ionization with salicylic acid ions, and diathermy is valuable in cases in which pain predominates. After the removal of the infective cause and when there are no signs of active inflammation, massage and movements of the bones to prevent the formation of adhesions, are indicated. Adhesions limiting the motion of the bone should be broken down under an anesthetic. The diet should be chiefly liquid, and of high nutritive value. Milk, cream, eggs, unheated juice of fresh oranges or lemons, fresh fruits or vegetables, fish, chicken and meat may be given according to the digestive capacity of the patient, along with general tonics.

**The Technic of Administering Local Anesthesia.** S. R. MAXEINER, Minneapolis, Minn., *The Journal-Lancet*, June 15, 1921.

Novocain is thoroughly effective and the safest local anes-

thetic available today. It may be used almost *ad libitum* if properly administered. Intravenous administration should be avoided. A tourniquet or adrenalin add to the duration of the anesthesia, but adrenalin solution is dangerous in the presence of a terminal circulation. Edematization of the field does not interfere with primary healing, and is the best and simplest method of producing anesthesia. Making secondary wheals is important, and when used in the abdomen all layers can be infiltrated in six minutes. Intraneural injections carry a larger percentage of failures and demands greater skill than paraneural injections or infiltration block. In the last method, a large amount of a more dilute solution may be deposited in proximity to the nerve. In circumferential infiltration, the operative field is circumscribed. This method is depreciated by the writer on account of the larger amount of solution required. In caudal anesthesia, the anesthetic is introduced through the terminal sacral foramen and is extradural. If successful, the anesthesia is excellent for work on the perineum and in the pelvis. Splanchnic anesthesia is rapidly gaining favor for abdominal operations.

**Present Problem of Local Anesthesia.** A. F. BRATRUD, Minneapolis, Minn., *The Journal-Lancet*, June 15, 1921.

Of the various anesthetics, quinin urea hydrochlorid used in 0.5% solution is very satisfactory, except in the skin, where it is apt to cause sloughing. It is preferable for prolonged anesthesia. Novocain is used in 0.5 to 4% in either normal saline solution or Ringer's solution. Apohesine is not meeting all that was claimed for it. Saligenin has been giving good results, and like novocain, produces little toxicity. As much as 300 c.c. of 0.5% solution of novocain can be used in one case. Gentleness and skill in handling the tissues are essential and gained only with experience. Suggestive remarks as to fear or pain by nurses, attendants, or spectators may change the attitude of a satisfied patient into one anticipating pain, and so cause complaint from most trivial noises or the slightest pressure. Narcotics are given as a rule, the morning of the operation, usually morphine, gr. 1-6 and scopolamin, gr. 1-200, which is not too much a dose to repeat in case of necessity.

The periosteum, perichondrium, and synovial membranes are very sensitive, bone insensitive, and bone marrow slightly sensitive. In the abdomen the parietal peritoneum is very sensitive, whereas the visceral peritoneum is not sensitive to pain. There is less manipulation and trauma of the tissues with the gentle technic necessary for the successful performance of major surgery under local anesthesia. Infection is not higher with local than with general anesthesia.

The author concludes:

1. The subject of anesthesia, local as well as general should be taught in all medical schools.

2. The disadvantages, such as time, infection, psychic factors, etc., are more imaginary than real.

3. Careful attention to details, better knowledge of anatomy, and improved technic are essential to success.

4. The post-operative course is a better convalescence in a shorter period of time, and complications are fewer.

5. Limitations of the field should be known, and combined anesthesia should be used as soon as there is a contra-indication to any further work under local anesthesia.

6. It is not the well-organized clinics with trained anesthetists that should have knowledge of this subject, but it is in the rural districts and hospitals without consultant or visiting anesthetists that it is important.

7. The future of local anesthesia depends upon the enthusiasm of the surgeon, knowledge of the subject, and, with these, the widening of the field of usefulness.

**Sea Bathing and the Ear.** ALEXANDER ROVINSKY, New York, N. Y., *Medical Record*, July 2, 1921.

During the bathing season ear affections gain markedly in frequency, due, in the opinion of the writer, to the entrance of sea water with its contaminating contents into the middle ear. The entrance of this water is through the mouth or nose into the posterior pharynx and thence through the Eustachian tubes, caused by a sense of choking, uncontrollable coughing, and an impulse to swallow. A day or two after bathing patients complain of discomfort, slight pain, and possibly itching in the ear; this latter stimulates scratching the respective spot either with the bare finger, or if situated



deeper, with pencil point, match, toothpick, or what not. As a result, the condition is aggravated and the pain becomes more and more marked. If the hyperemia, infiltration, or abscess is near the meatus of the external auditory canal, the pain is less, but the tenderness severe. In pronounced cases the pain may be felt all over the side of the head with pain behind the ear, simulating mastoiditis. People who suffer with any defect that interferes with normal breathing such as marked deflection of the septum, hypertrophied turbinates, tonsils, adenoids, or any other retropharyngeal growth, should be warned against the possibility of ear affections during sea bathing, and the least appearance of inconvenience or pain calls for immediate consultation with the family physician. Those predisposed to the formation of cerumen in the ear should be instructed to clear the ears of the same before bathing, as the sea water is apt, instead of disintegrating the ceruminous mass, to cause it to swell by absorption, and thus cause trouble. Those suffering from acute middle ear disease or active chronic purulent affection should be prohibited from sea and river bathing altogether; this applies with even greater force to sufferers from any labyrinthine affection. Patients with chronic catarrhal ear disease, while permitted to indulge in bathing, should be warned against staying in the water too continuously, and against too strenuous swimming and especially diving; instead of diving, they may be advised to duck with the nostrils and ears obstructed with their thumbs and index fingers of the respective side. Those suffering with latent or periodic purulent otitis should have their ears stuffed with plugs of absorbent cotton dipped in albolene or olive oil, and wear a closely fitting rubber cap over their ears, avoid diving or ducking and always keep above water; immediately after bathing remove plugs and dry canal. Any appearance of pus or the least pain calls for immediate cessation of bathing and for medical advice. Those predisposed to furunculosis of the external canal should protect the canal with some borated vaseline or zinc oxide salve.

A danger which, though it may appear far fetched, is nevertheless within the domain of the possible, is injury to the drum when the bather exposes his side to the onrushing wave, and the ear is thus struck sideways with considerable force. It is a well known fact that in certain class of patients syringing of the ear, even with warm water (as it should properly be done), not to speak of cold, is apt to produce dizziness and even fainting, no matter how mild the force of the injected stream. It stands to reason that when a volume of cold water strikes the drum with sufficient force, it is apt to produce dizziness and even unconsciousness which may be followed by drowning.

#### A Report of Fifty Consecutive Cataract Operations by the Smith-Indian-Fisher Method. F. J. PRATT, J. A. PRATT, Minneapolis, Minn., *Minnesota Medicine*, June 1921.

Until the beginning of the eighteenth century all opacities (apparent or real) of the optic media were included under the term "cataract." Beard's classification is given as follows:

1. According to the age at which it appears: congenital, juvenile, adult, senile.
  2. According to the cause: spontaneous, traumatic, symptomatic, albuminuric, arterio-sclerotic, chemic, thermic, heat, cold, electric, diabetic, glaucomatous malarial, phosphaturic, naphthalmic, spasmodic, ergotinic, ciliary cramp, tetanic, thyroidismic, uveitic.
  3. According to consistency: liquid, soft, semi-hard, hard, ossific, calcific.
  4. According to color: white, gray, greenish, amber, black, blue.
  5. According to extent: total, partial, nuclear, perinuclear, cortical, capsular.
  6. According to the seat and disposition of the opacities: central, nuclear, perinuclear, anterior, cortical, posterior cortical, anterior polar, equatorial, disseminated, punctate, zonular.
  7. According to the presence or absence of complications: simple, complicated.
  8. According to the period of development: incipient, or commencing, immature, mature, hyper-mature or regressive.
- Almost all pathologic changes that affect the nutrition of the eyeball are etiological factors. Herbert divides the stages

of development of the cataract into (1) incipient, (2) unripe, (3) ripe, or mature, (4) over-ripe. With the Fisher operation it is not necessary to wait for the cataract to get "ripe." The success of the operation and the after-results depend on several factors: first, the preparation of the patient; second, the patient on the operating table; third, the operator and his assistant; fourth, the complications during the operation; fifth, the behavior of the patient after the operation; sixth, the after inflammation; seventh, the clearness of the pupil; eighth, the condition of the vitreous and fundus.

The resultant vision in 50 cases of completed Smith-Indian-Fisher operations were as follows:

10 cases.....	20-20
15 ".....	20-30
6 ".....	20-40
6 ".....	20-50
2 ".....	20-60
1 ".....	20-70
1 ".....	20-80
1 ".....	20-100
1 ".....	20-150
1 ".....	20-200
1 ".....	3-200
5 ".....	not refracted

## Book Reviews

**Surgery, Its Principles and Practice.** By Various Authors. Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Emeritus Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. *Volume VII.* Royal octavo; 855 pages; 359 illustrations, 17 of them in colors. *Volume VIII.* Royal octavo; 960 pages; 657 illustrations; 12 of them in colors. Philadelphia and London: W. B. SAUNDERS COMPANY, 1921.

Keen's "Surgery" was completed in 1913 by the publication of its sixth volume. In the eight subsequent years so much has been added to surgery, so many developments has the recent war brought about in the treatment of wound infections and of injuries of the bones, joints, bloodvessels, face, thorax, brain and nerves, that the venerable and venerated Nestor of American surgery has thought it proper that these should be incorporated in the splendid work that bears his name.

Those who are familiar with the first six volumes will not need to be told what to expect in these two large supplemental volumes. They constitute not merely an admirable exposition of war surgery in all its phases, including its application to the surgery of peace, but also an exposition of the recent progress in other surgical fields, as for example, the thyroid gland (C. H. Mayo, L. B. Wilson, E. C. Kendall), the hypophysis (A. W. Adson), the Gasserian ganglion (C. H. Frazier), the prostate (Hugh Young), gonorrhea in females (C. C. Norris), anesthesia (Boothby, Booth, Harris, Cabot), radium therapy (Duane and Greenough), tropical surgery (McCaw), etc., etc. The authorship of these two volumes is chiefly American, but partly Canadian (Adami, Armstrong), English (Jones, Hey Groves, Thorburn, Cuthbert Wallace), and French (Eugene Darcissac, who has contributed the chapter on The Role of the Dental Surgeon in the Treatment of Fractures of the Jaw).

A separate Index Volume for the entire work has also been published.

**Studies in the History and Method of Science.** Edited by CHARLES SINGER. *Volume II.* Imperial octavo; 559 pages; 55 plates and many illustrations. Oxford: THE CLARENDON PRESS, 1921.

This volume is even more interesting and fascinating than the remarkable Volume I, printed in 1917. We are not surprised by the statement of the editor that the issue thereof was soon exhausted. It was a novel venture in the recital of the history of science and nothing was left undone to give distinction to the publication. Both volumes are truly notable



in character, in material and in the manner of execution. The articles are without exception solid, written with a fine scholarliness and historical perception, and the choice of subjects is unhackneyed, in many instances consisting of virgin material.

Of the fifteen articles in this volume, seven are of direct medical interest; the remainder ought to interest any physician who has any leanings to general culture. The opening article of over 100 pages, by the editor, Dr. Singer, on Greek Biology and its Relation to the Rise of Modern Biology, is a remarkable account of the bases of the Aristotelian biological system, some Aristotelian zoological observations and their modern counterparts, the botanical knowledge of the ancients and the botanical results of Theophrastus compared with those of the early modern botanists. It is richly illustrated, both in black-and-white and in color. The article on Roger Bacon and the State of Science of the Thirteenth Century, by Robert Steele, is a brilliant study of one of the most remarkable minds the world has ever known and the historical background of his time. The modernity of Roger Bacon's mind is an eternal wonder. The article on Leonardo the Anatomist, by H. Hopstock, is an elaborate study of the famous illustrations and manuscripts preserved at Winsor, and will prove highly informative to those who have had only a vague knowledge that Leonardo dabbled in anatomy. After learning what Leonardo knew of anatomy, one wonders how profoundly his work might have influenced the development of this subject had these manuscripts seen the light of day earlier. Leonardo was no amateur in anatomy. He knew many things that even Vesalius was ignorant of, and his knowledge was obtained through first-hand observations. In the fine account of the Asclepiadae and the Priests of Asclepius, by E. T. Withington, he tries to show that Hippocratic medicine did not originate in the temples of Asclepius or the healing shrines of ancient Greece, but represents the summary of an art that had existed probably centuries before the birth of Hippocrates, the physician. The History of Anatomical Injections, by F. J. Cole, is a very readable and interesting story. It is surprising to know that the first account of anatomical injection in literature dates back to Berengarius in 1521. The article on Four Armenian Tracts on the Structure of the Human Body, by F. C. Conybeave, is a translation of ancient manuscripts in the British museum. It affords quaint and curious reading.

Space forbids entering into any sort of critique in regard to the remaining contents of this volume, but we cannot help mentioning the excellent account of the scientific works of Galileo, by J. J. Fabie, and that on The Invention of Optical Apparatus, by Singer.

In the preface, Dr. Singer calls attention to the increasing spread of interest in the history of medicine. He is certainly responsible to a considerable degree for this, not only through his own writings but through the publications of such volumes as this.

**The Surgical Clinics of North America. Volume 1, Number 1, Philadelphia Number.** With an Introduction by W. W. KEEN, M.D., LL.D., Emeritus Professor of Surgery, Jefferson Medical College, Philadelphia. Volume 1, Number 2, New York Number. Octavo; each about 250 pages; illustrated. Philadelphia and London: W. B. SAUNDERS COMPANY.

The publication of well selected clinical lectures and demonstrations, well edited and adequately illustrated, as are these, serves a very useful purpose. It brings the clinic to the doctor; it gives to him who has not been able to hear it the opportunity to read it; and such reading supplements and vivifies the more condensed and didactic teaching of his textbooks.

We have read much of the first two numbers with interest and with profit. The Philadelphia number contains clinic lectures by Charles Frazier (an excellent one on sensory root section and alcohol injection for trigeminal neuralgia), J. C. Da Costa, A. P. C. Ashhurst, John G. Clark, John B. Deaver, John H. Gibbon, John H. Jopson, George P. Muller, Charles F. Nassau and T. Turner Thomas. The New York number contains clinics by Fred H. Albee, John F. Erdmann, Charles L. Gibson, Leo Buerger, Willy Meyer,

John Hartwell, Charles G. Heyd, Walton Martin, Eugene Pool, F. B. St. John, Byron Stookey, Allen O. Whipple and Kenneth Johnson.

T. Turner Thomas, who has insistently claimed that brachial birth palsies arise from injuries to the shoulder (capsular tears) will find no comfort in the here recorded clinics of Ashhurst and of Stookey.

**The International Journal of Gastro-Enterology. Volume 1, Number 1, New York: July, 1921.**

Dr. Angelo L. Soresi, a New York surgeon whose frequent contributions to current medical literature exhibit an original and fertile mind, has established a new journal, of which he is the editor and, apparently, the publisher. The first number, which appeared last month, is attractive in type, paper and execution of the numerous illustrations, and contains excellent articles by representative men dealing with the physiology, surgery and medicinal treatment of affections of the stomach and intestine. As its name implies, the journal is intended to be international in character; some of the matter in this first number is in French, some in Italian, but most of it is in English. The journal has other unusual features, two of which seem especially worthy of note: Following each article are "commentaries" thereon by competent colleagues, selected by the editor for the purpose; these partake of the nature of "discussions", as at society meetings. Contributions reporting discoveries or innovations in methods that have not been long enough tested to establish them will be published, presumably at the editor's discretion, under "Preliminary Notes"; this is intended to encourage investigation and establish priority, as a protection to the author and to indicate the perhaps still experimental character of the contribution, as a protection to the reader. Hereafter there will be published with each article an abstract of its contents in the other chief languages. The journal contains no advertising.

Dr. Soresi has done very well indeed with his maiden issue, and we wish him success in his ambitious venture. We would call his attention to certain minor faults that he can easily correct: "The Table of Contents" bears no page numbers; there is no statement concerning the intervals at which the journal is to appear; there is no publication address other than that of the editor; the names of authors of original articles appear in light type, while the authors of "commentaries" are unduly favored with larger, heavy type!

**Medical Notes.** By SIR THOMAS HORDER, M.D. (Lond.), F.R.C.P. (Lond.), Physician, with charge of Out-Patients, to St. Bartholomews Hospital. Duodecimo; 112 pages; London: HENRY FROWDE, Oxford University Press; HODDER & STOUTON, 1921.

A very interesting compilation of notes and comments originating in the practical experiences of a capable observer in hospital wards and out-patient departments. The general type of these notes is similar to that of the "Surgical Suggestions" appearing in this Journal.

## Books Received

**Practical Chemical Analysis of Blood.** By VICTOR CARYL MYERS, M.A., PH.D., Professor of Pathological Chemistry in the New York Post-Graduate Medical School and Hospital. Octavo; 121 pages; illustrated. St. Louis: C. V. MOSBY COMPANY, 1921.

**Progressive Medicine.** A Quarterly Digest. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics, Materia Medica and Diagnosis in the Jefferson Medical College, Philadelphia; Physician to the Jefferson Medical College Hospital, etc. Assisted by LEIGHTON F. APPLEMAN, M.D., Instructor in Therapeutics, Jefferson Medical College, Philadelphia; Ophthalmologist to the Frederick Douglass Memorial Hospital and to the Burd School, etc. Volume II. Octavo; 399 pages; illustrated. Philadelphia and New York: LEA & FEBIGER, 1921.



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## HEMORRHAGIC OSTEOMYELITIS.

(GIANT-CELL SARCOMA, GIANT-CELL TUMOR.)

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The term *hemorrhagic osteomyelitis* was first used about ten years ago to denote and describe a lesion in bone that had up to that time been considered a malignant neoplastic process.

During this period of almost a decade, a profound change in the point of view of the profession as a whole, appears to have taken place regarding the proper classification of this important pathologic structure. This change in mental attitude is to be

criteria, in both its gross and histopathologic aspects, of an inflammatory affection.

Such designations should be discontinued; they are inadequate, inexact, confusing, misleading, and in fact misnomers.

The conclusions reached by many of our foremost pathologists in relation to the scavenger or foreign-body type of giant-cell encountered in these lesions, absolves the cells from having any function in the rôle of tumor formation. In attempting to reach a decision whether a process in bone should be considered either neoplastic or inflammatory, from the microscopist's angle of investigation, one must disregard the giant-cell content. Such cells are the



Fig. 1. Hemorrhagic osteomyelitis, upper end of femur before operation.

found more particularly among those whose studies and experience have been along the lines of bone pathology and surgical therapeutics.

It is now better recognized that malignancy is not a feature or characteristic of the osseous pathologic process that has for a long time been diagnosed as giant-cell sarcoma and, more recently, giant-cell tumor. These terms are, however, still being commonly used to denote and describe the lesion. This is unfortunate because the process carries all the



Fig. 2. The same case, following operation. The cavity has been filled out with bone shavings.

known accompaniment both of inflammations and neoplastic disease; their presence, therefore, cannot be affirmative of tumor growth. This is true only of the scavenger or foreign-body type of giant-cell.

The true tumor giant-cells present quite a different histopathologic picture, that should not be confused with the scavenger forms. They are infrequently found in bone sarcomata; when encountered they denote extreme malignancy.

For a number of years I have endeavored to keep before the profession the fact that these bone affec-



tions commonly termed giant-cell sarcomata are really not neoplasms, but definite inflammations; they are always hemorrhagic in type, non-suppurative, and chronic in character.

One cannot question the possibility that, in rare instances, a neoplastic process may arise in primary granulation tissue. Particularly is this understandable where the effort at complete repair and restoration of a structure has been unsuccessful. If, however, such neoplastic degenerative change should occur, the known characteristics of malignancy become readily observed in a microscopic picture, presenting mitotic figures, aplasia, and cellular invasion of a special type of tissue. When such histopathologic features of malignancy and autonomous

The picture practically always observed in the primary stage or phase of the affection termed *hemorrhagic osteomyelitis* exhibits all the factors covering our modern conception of granulating tissue structure, both in its cellular or histologic make-up and in its gross or naked-eye appearance.

Early efforts at repair in any non-suppurative area of osteolysis exhibits a picture similar to the process termed hemorrhagic osteomyelitis, giant-cell sarcoma, or giant-cell tumor. The same type of hemorrhagic granulation tissue structure is beautifully illustrated in early efforts at repair in fractures in bone; also exactly the same tissue structure may be brought forth experimentally, in suitable operations upon normal bone, or in soft tissues.



Fig. 3. The same case. Result 6 years after operation. growth are absent, there appears to be no justification for terming a lesion sarcomatous. The term "giant-cell tumor" seems to be equally inexact as a designation for these inflammatory processes.

The consensus of opinion today is against crediting giant-cells of the scavenger or foreign-body type with the power of tumor formation. On the other hand, it is quite well recognized that they do act as scavengers in performing the function of removal of sterile débris. This appears to be their only action.

It has been suggested quite recently that these bone lesions should be looked upon as borderline cases; that is, between an inflammation and a neoplasm.

In my opinion present methods of investigation are ample to permit us to decide definitely whether a lesion is inflammatory or neoplastic.

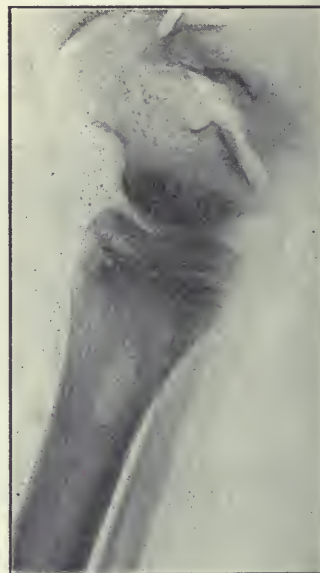


Fig. 4. Hemorrhagic osteomyelitis. Small lesion in lower end of tibia in patient 7 years of age.

These facts should have weight against a diagnosis of neoplasm.

Recently published text-books on surgery and pathology, and numerous clinical discussions and medical papers bearing upon the subject appear quite generally to accept the inflammatory character of these processes in contradistinction to neoplastic growth.

The solitary lesion has been seen and studied by me in all bones of the body exclusive of the skull, clavicles, scapulae and manubrium.

Thus far only one case with multiple lesions in several bones giving anatomic proof of a hemorrhagic osteomyelitis has been personally studied.

In my observation the lower extremities have been the sites of the lesion in the proportion of about 3 to 1, compared with the rest of the body.



In 40 personally observed patients suffering with hemorrhagic osteomyelitis twenty-eight of the lesions were in the lower extremities, distributed as follows:

Metatarsals .....	1 case
Os calcis .....	2 cases
Tibia .....	11 cases
Fibula .....	2 cases
Femur .....	12 cases
Total .....	28 cases

Of the total 28 cases 20 were in males and 8 in females. The oldest patient in the series was 63 years, the youngest 18 months.

Six lesions in the femur were in the lower end, and six were in the upper end. The youngest pa-

has been only one case observed in a child 10 years of age. The youngest patient in this group was 18 months old, the oldest 39 years.

The smallest lesion found in the tibia was the size of a large coffee bean, the largest the size of a baseball.

Two cases in the fibula were in the upper end, one in a female 20 years of age, and one in a male 24 years old.

The two cases in the os calcis were both males; one was 18 years old and the other 47 years.

Twenty-seven cases exhibited some degree of disability, from slight limp to distinct lameness. Limitation of motion was generally more marked in lesions

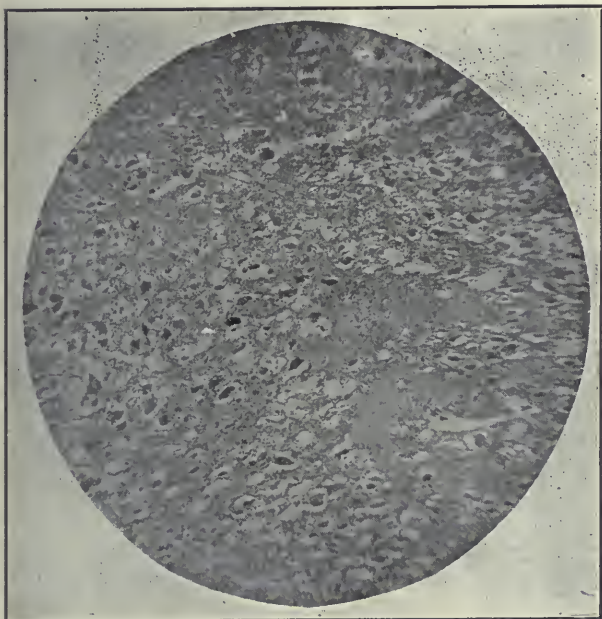


Fig. 5. Hemorrhagic osteomyelitis. Photomicrograph, low power. Tissue removed from upper end of femur in a patient 17 years old.

tient with lesion in the upper end was 4 years, the oldest 19 years. The youngest patient with lesion in the lower end of the femur was  $3\frac{1}{2}$  years and the oldest 63 years. Eight of the patients in this group of 12 were males and 4 females.

The smallest lesion found in the femur was the size of an ordinary cherry, the largest the size of a big orange.

Of the 11 cases in the tibia 8 were in males and 3 in females; 10 presented lesions in the lower end and 1 in the upper end.

It is interesting to note that up to the present I have encountered only one lesion involving the upper end of the tibia in a child. I have seen several cases in consultation where the upper end of the tibia in adults has been involved, but thus far there

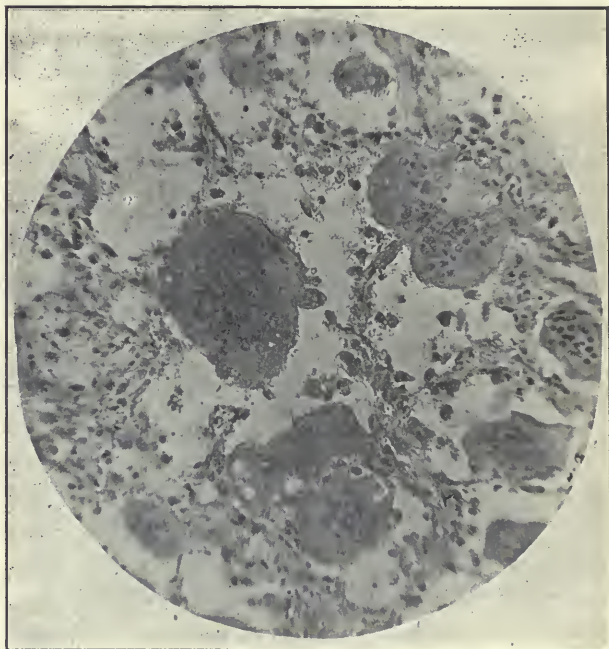


Fig. 6. Photomicrograph, high power, showing typical scavenger giant-cells, constantly present in lesions containing areas of ancient hemorrhage.

near the hip joint than in those near the knee or ankle. In practically all cases one could elicit a history of recent or ancient trauma.

In all the 27 cases a localized area of pain could be demonstrated on pressure over lesion.

One case was accidentally discovered in the lower end of the tibia. This patient was without symptoms. Deep pressure over the site of the area of osteolysis exhibited by roentgenogram elicited pain. Joint motion in the ankle was normal.

It may be definitely stated that a preliminary diagnosis is impossible without the use of the *x*-ray. It should also be emphasized that an area of osteolysis exhibited by the *x*-ray may mean one of many other gross pathologic lesions. At times it may be necessary to combine the clinical and *x*-ray pictures with



the gross and microscopic studies, to make a positive diagnosis of hemorrhagic osteomyelitis. As a rule, however, a carefully studied clinical picture with the information conveyed by the roentgenogram is sufficient for a correct diagnosis.

The following table covers the more important features pertaining to the solitary lesion in making a diagnosis of hemorrhagic osteomyelitis:

*Clinical Picture*

Age of Patient.....	May occur at any age. Most frequent in first and second decades of life.
Duration of Lesion.	Months—perhaps years before lesion attains large size.
Symptom of onset..	Usually history of injury, recent or remote.
Pain.....	Apparently never constant.
Inspection.....	Usually some enlargement at site of lesion.
Palpation.....	Tenderness and pain on pressure.
Joint movements ...	Some limitation of motion in nearest joint. Limp with lesion in lower extremity.

*X-ray Pathology*

Cancelli.....	Area of osteolysis rather clear cut, rounded or oval in shape.
Periosteum.....	Usually intact unless lesion has attained large size, years after onset.
Gross Pathology....	Appearance of vascular granulation tissue sometimes interspersed with areas of fibrosis, or degenerated hyaline masses.

*Microscopic Picture.* Heterogeneous cellular picture of fibroblasts, scavenger giant-cells, endothelial and polynuclear leucocytes, lymphocytes, eosinophiles and red blood cells.

In only one instance in this series of cases have more radical operative measures than curettage been attempted. Insofar as it has been possible to ascertain there has been no recurrence of disease in any patient operated upon during a period of almost ten years. Believing the process to be purely inflammatory in nature, following curetting, we have avoided using chemical destructive agents in the cleaned out cavity. On the contrary, in order to increase stimulation, and promote the effort of healthy granulations, that may finally become bone and bring full anatomic restoration of tissue, swabbing with tincture of iodine has been used as a routine. Perhaps the swabbing is unnecessary. Depending upon the size of a cavity or space left following curetting, one's judgment comes into play, whether or not to fill in with bone shavings, chips or bone graft. Any lesion smaller than a pigeon's egg needs no filling.

Successful end-results are the final factors that appeal to both patient and surgeon following treatment of cases. When such may usually be attained safely by minor surgical measures there can be no justification for radical and mutilating operations sometimes performed when these lesions are falsely stigmatized "sarcomata."

## THE INJECTION OF OXYGEN INTO JOINTS FOR DIAGNOSIS.

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About two years ago, at a local medical society, Drs. Arthur Stein and William H. Stewart of New York City, presented roentgen-ray pictures of patients into whose peritoneal cavities oxygen had been injected. The pictures showed very clearly the outlines and positions of the solid organs and peritoneal adhesions, and the method they described appeared likely to prove a great aid in diagnosis. The areas occupied by the oxygen were very light, and the usually ill-defined shadows of the abdominal organs were much intensified. It was apparent that under favorable circumstances this method could be used also in the study of soft tissues not recognizable in the ordinary roentgenograms. The practice of intraperitoneal injection of oxygen and roentgenography had been used previously, and has been greatly extended recently in the study of subdiaphragmatic, pelvic and other intraabdominal conditions. In joints it had been used to only a very limited extent, and without particularly encouraging results. There are many joint conditions in the study of which additional aid is needed; and it was hoped that the intraarticular injection of oxygen might help to differentiate the various types of internal derangement of the knee, and be of value in doubtful cases of loose semilunar cartilages, resistant chronic synovitis and other joint lesions. I felt, therefore, that the method ought to be given a trial, particularly as it had been used without any ill-effects.

A search of the literature showed that about 10 years ago oxygen had been injected into joints by French and German surgeons, but there was no clear record of the technic employed, the effects on the joints, or the results accomplished. Recently I found an article by a French military surgeon who injected oxygen for therapeutic purposes into the knees of five cases of hydrarthrosis and hemarthrosis with excellent results. At the last meeting of the American Medical Association in Boston, Sir Robert Jones told me that he had injected oxygen into the joints of 40 patients about 20 years ago. He had employed about the same method that I used, with satisfactory results. After several experimental injections into the joints, I found that the injection when performed under aseptic precautions was not accompanied by any untoward effects. The animals and their joints were apparently normal a few minutes after the injection. I therefore deter-



mined to use it in the joints of human beings, and shall briefly relate my experiences in a few of the cases.

CASE I. Mrs. W. Following an injury, her left knee became painful and swollen and she walked at times with a limp. There was no history of locking. When I saw her in 1919 the knee was swollen, there was no local heat, and tenderness was present at the joint line anteriorly, sometimes on the inner side and sometimes on the outer. The motions were somewhat painful and very slightly restricted. There was some crepitus on motion. Roentgen-ray pictures were negative. She had apparently some internal derangement of the knee with possible injury to the semilunar cartilages. The diagnosis was not

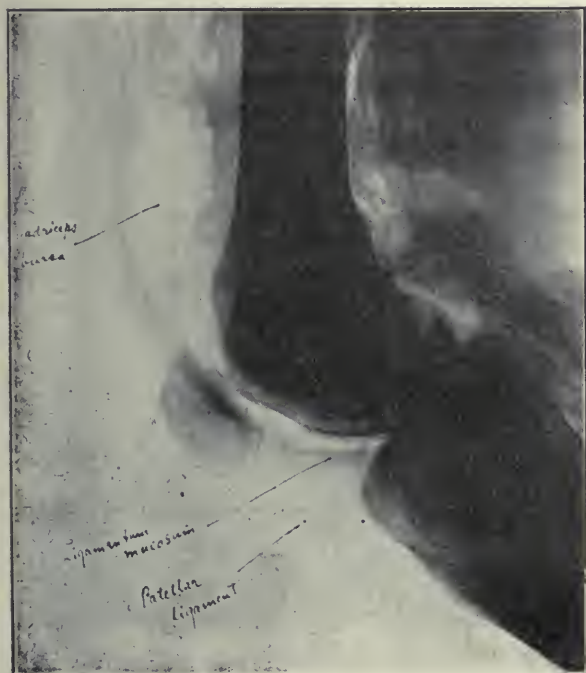


Fig. 1. Case I. F. W. Chronic synovitis, possible loose internal semilunar cartilage. Lateral view after oxygen injection. Note distension of joint with oxygen and also oxygen in intermuscular planes.

clear and the case seemed an appropriate one for the use of oxygen.

On Nov. 24, 1919, I made my first trial of the method in the following manner. The patient's limb was prepared as if for an operation and she was taken into the operating room. The skin over the knee was painted with tincture of iodine, a small square just above and external to the patella was anesthetized with novocain, and a needle about 2½ inches long was inserted into the quadriceps bursa. The barrel of an ordinary hypodermatic syringe was then attached to the needle and a sterile tube connected the oxygen tank with the syringe barrel. A moderate amount of gas, sufficient to produce an evident distension, was allowed to enter the joint. The needle was withdrawn and a dressing was applied. The patient was then taken to the x-ray laboratory. By the time she got there some

of the oxygen had escaped. The knee was x-rayed and the pictures compared with those taken before the injection. The second group of pictures showed oxygen in the cul-de-sac, but in no other part of the knee. Five days later the knee was again injected. This time the needle was inserted just below and external to the patella and without anesthetizing the skin. The injection was made in the x-ray laboratory so that as little as possible of the gas would be lost before the pictures were taken. Roentgenograms (figures 1 and 2) showed that the gas had entered the knee-joint proper and had also distended the cul-de-sac. Some of the gas escaped into the subcutaneous tissue and into the intermuscular planes. Slight pain was felt during the injection, but none afterward. The gas disappeared in 36 hours, but the patient was kept in bed 3 days be-



Fig. 2. Case I. F. W. Chronic synovitis, possible loose internal semilunar cartilage. Antero-posterior view after oxygen injection. Dark lines above tuberosities of tibia indicate semilunar cartilages. Light area below dark lines indicates oxygen beneath semilunar cartilages.

fore she was permitted to use the limb. There were no ill-effects and she could walk as well as before the injection.

The antero-posterior picture (figure 2) showed a dark line above the external tuberosity of the tibia extending from its external border to the spine. There was a similar line above the internal tibial tuberosity, but it extended only part way across the spine, from the internal border to the junction of the middle and external thirds. These lines were interpreted as indicating the semilunar cartilages, the oxygen having presumably gotten under the cartilages and lifted them up. The break in the line of the internal cartilage was assumed to indicate a rupture of this meniscus. This interpretation was not verified by operation.

CASE II. Mrs. L. had chronic, so-called rheumatoid polyarthritis. Her right knee was moderately swollen, flexed and painful. This joint was in-



jected for purposes of study. The injection was made in the x-ray laboratory with the same technic as in the previous case. The knee was painted with iodine, the needle, the glass barrel and the tubing were sterile and I scrubbed my hands as if for an operation and used sterile gloves. The needle was inserted into the knee joint just below and external to the patella. No attempt was made to measure the amount of oxygen used. The oxygen was injected very slowly and when the knee became ballooned up to a degree equal to the enlargement that would be seen in a moderate grade of synovitis, the injection was stopped. X-ray pictures were taken and they showed very distinctly the outlines of the joint, the patellar ligament, the cul-de-sac, the bursae, but no discernible abnormalities. During the injection the patient had some discomfort, but it disappeared

was necessary, for if the needle was inserted rapidly there was only very slight discomfort. The needle was inserted into the bursal sac at a point about one inch below the acromian process on the external aspect of the shoulder. A few cubic centimeters of yellowish turbid fluid were allowed to escape. A tube was then attached to the needle and the oxygen injected. It filled the bursa rapidly, and for the time being caused the patient some discomfort. X-ray pictures, then taken, showed the outline and size of the bursa very clearly (figure 3). There was no gas in the shoulder joint proper. The bursa was seen to extend from  $\frac{5}{8}$  of an inch under the acromian process down over the arm for a distance of  $2\frac{1}{2}$  inches. The picture taken with the patient standing up showed gas in the upper third of the bursa and a cloudiness of irregular density in the lower

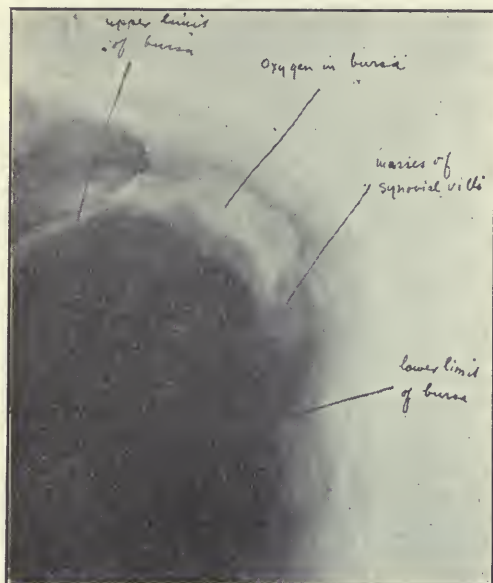


Fig. 3. Case 3. M. R. Subdeltoid bursitis. Anteroposterior view after oxygen injection. Note mass of synovial villi indicated by dark shadow, and oxygen in bursa above this shadow. No communication between bursa and shoulder joint.

when the injection was stopped and was evidently due to the distension of the joint. The gas disappeared within 48 hours and there were no untoward effects. I noticed, however, that the flexion-contraction of the knee was considerably reduced. The patient was distinctly improved after the injection; there was great relief from the discomfort she had been having during her many months of illness. She requested a second injection of the same knee, and later asked that her other joints be injected. This was done. The relief from pain and the reduction of the flexion of the knees were not permanent.

CASE III. Mr. R., 66 years old, had been suffering for a year from chronic subdeltoid bursitis of the right shoulder. There was a very distinct enlargement of the bursa with fluctuation and crepitus on manipulation. The bursa was evidently distended with fluid and a considerable amount of villi. We had learned by this time that no local anesthetic



Fig. 4. Case 4. J. D. Loose body in knee joint. Lateral view after oxygen injection. Note loose body above patella. Pedunculated mass of synovial tissue located above patella and removed.

two-thirds, with a distinct fluid level. The shadow in the lower part was evidently due to the fluid and the villi. These pictures showed not only the outline and extent of the bursa, but also that the bursa in this instance was filled with both fluid and irregular masses of soft tissue. A few minutes after the injection the patient had no discomfort whatever. He went home about one hour after the injection and suffered no untoward effects.

The chief points of interest demonstrated by this case are:

1. The practicability of injecting oxygen in an out-patient department, at least in non-weight bearing parts.
2. The subdeltoid bursa can be injected and its outlines demonstrated.
3. The injection of the subdeltoid bursa is neither difficult nor very painful.



4. At least in this case the bursa was apparently not connected with the joint.

CASE IV. Mrs. J. D. complained of a loose body in the knee. She stated that she could feel it and had several times located it at a point just above the patella. On examination the knee was negative. There was no swelling or tenderness, and the loose body could not be felt. An x-ray examination was also entirely negative. The knee-joint was then injected with oxygen. The lateral view showed that the joint was thoroughly distended with oxygen and just above the patella there was a shadow about  $\frac{1}{2}$  inch square (figure 4). This corresponded with the location where the patient said she had felt the loose body. She was operated upon and a mass of synovial and fibrous tissue was found above the patella,

They showed a dense shadow of pathological soft tissue filling up the cul-de-sac and apparently joining the quadriceps to the femur. The femur appeared normal and the swelling was, therefore, due to pathological changes in the quadriceps bursa. There was also a shadow of soft tissue in the interval between the tibia and femur. This patient was operated upon and a dense sheet of fibrous and synovial tissue was found lying underneath the quadriceps, joining it to the surrounding tissues. It filled the quadriceps bursa, covered over the femoral condyles and dipped down between the femur and tibia. A large section of this tissue was excised and the wound closed. Microscopical examination showed this tissue to be tuberculous. Subsequently the patient developed typical signs of joint tuber-

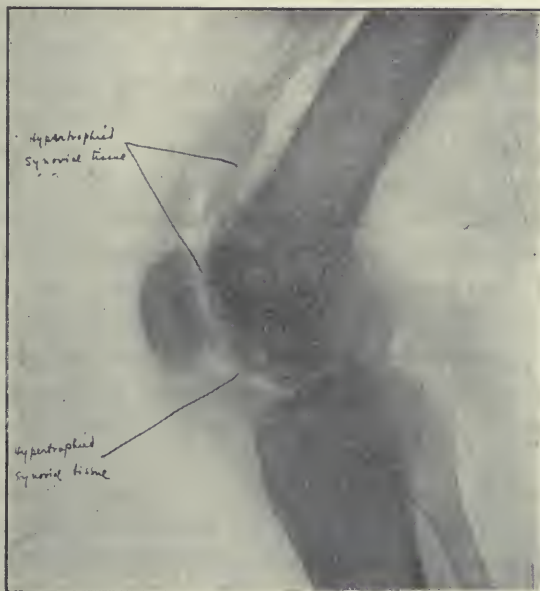


Fig. 5. Case 5. B. B. Tuberculosis of knee. Lateral view after oxygen injection, showing hypertrophy of synovial tissue. At operation, very dense mass of synovial tissue found filling the entire knee-joint. Part of this tissue removed. Microscopical examination showed tuberculosis.

attached to its upper border by a pedicle which allowed a considerable range of motion. This was removed and the patient has had no further trouble. In this instance the oxygen injection was definitely helpful in locating the cause of the symptoms.

CASE V. Miss B. B., 22 years old, was sent to me for a swelling of the lower part of the left thigh and knee. She had had this condition for about two years, but the symptoms had become much aggravated in the last six months. There was great swelling and tenderness in the region of the femoral condyles, and it was feared that she had a neoplasm. X-ray pictures were negative. (There was a slight defect in the upper extremity of the tibia, which was not appreciated at this time.) The femoral condyles were apparently normal. The joint was injected with oxygen and again x-rayed. The subsequent pictures (figure 5) were entirely different from those taken before the oxygen injection, and were very instruc-

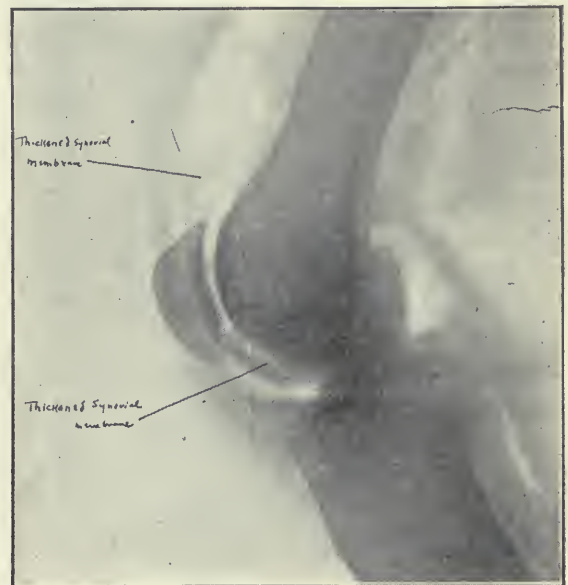


Fig. 6. Case 6. K. A. Traumatic chronic synovitis. Lateral view after oxygen injection. Patient recumbent. Note oxygen (light area) through joint. Also thickened synovial membrane. Note distension of the knee-joint by the oxygen. Very large mass of hypertrophied synovial membrane and villi removed from upper part of knee.

culation with extensive excavation and loss of tissue of the femur and tibia. In this case the oxygen injection was helpful in definitely locating the pathological changes.

CASE VI. Mr. K. A., 60 years old, injured his left knee two years ago and had as a result a synovitis that resisted all of the usual forms of treatment. The knee was aspirated several times and the fluid was found to be sterile. X-ray examination was negative. The joint was injected with oxygen and the pictures (figures 6 and 7) showed an extensive shadow of pathological tissue in both the quadriceps and in the interval between the tibia and femur. The shadow was diagnosed as hypertrophied synovial tissue. At operation the synovial membrane was found to be enormously hypertrophied and congested. A large mass of this tissue was removed and the patient has had no recurrence of symptoms. In this case the injection was helpful in confirming



the diagnosis of hypertrophic synovitis, and justified the advice that an operation was indicated.

CASE VII. Miss T. H., 22 years old, gave a very distinct history of injury to the left internal semilunar cartilage. She had wrenched her knee and since then the joint had become locked several times. There was a mild synovitis and tenderness over the internal semilunar cartilage. X-ray pictures were negative. The joint was injected with oxygen and again x-rayed. In the region of the internal meniscus there was no abnormality. Above the external tuberosity there was a light line (oxygen) and a darker line above it. The darker line was taken to be the shadow of the external meniscus. This patient was operated upon, the internal meniscus was

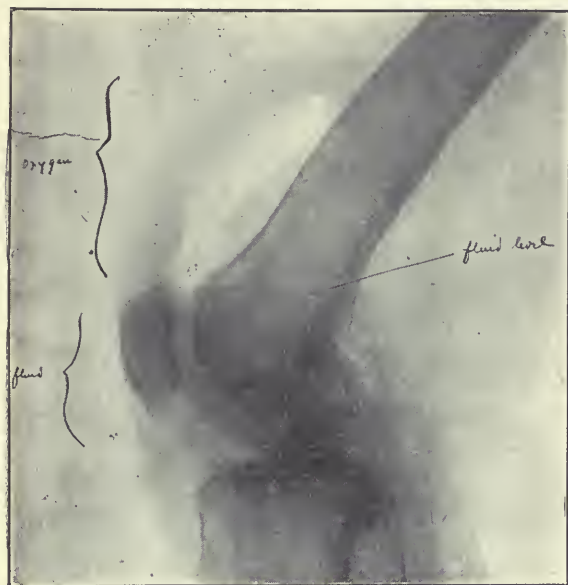


Fig. 7. Case 6. K. A. Traumatic chronic synovitis. Lateral view after oxygen injection. Patient standing. Note upper level of the synovial fluid with oxygen (light area) above it.

found to be very loose and was removed. The external meniscus could not be seen on account of the small size of the incision.

In this case the oxygen injection was not helpful. It was interesting to note the apparent elevation and laxity of attachment of the external meniscus. Sir Robert Jones in a personal interview told me that the external meniscus is normally looser than the internal and that that may explain the appearance in this picture. In other cases injected with oxygen, however, I have not noted this apparent looseness of the external meniscus.

CASE VIII. R. P., male, 10 years old. This patient had what appeared clinically to be a very mild infectious arthritis of the left knee, the cause of which was unknown. X-ray pictures were negative. Oxygen was injected for diagnostic purposes. Subsequent x-ray pictures were similar to those in case 6; they showed a fairly dense shadow in the quad-

riceps bursa and in the interval between the tibia, patella and femur. The bones were normal. Evidently there was thickening of the synovial membrane and the boy was suffering from a hypertrophic synovitis. Incidentally it should be mentioned that the joint held very little oxygen. I had the same experience in the injection of other joints of children, namely, that they are very small and hold only a small quantity of gas.

#### TECHNIC OF THE INJECTION OF OXYGEN INTO JOINTS.

The injection of oxygen into joints is a simple procedure. The apparatus needed consists of a tank of oxygen, a rubber tube about 2 yards long, a barrel of a hypodermatic syringe and a stout needle about 2 inches long. The needle, barrel and tube are sterilized and are attached to the oxygen tank. Some gas is allowed to pass through the tube and needle. This serves the double purpose of clearing the track of the tube and needle, and of gauging the pressure of the gas. It is preferable to use a tank in which the pressure is very low, for if it is high the tube will be blown off the barrel and may break the barrel if it is of glass, and even break the needle. The injection should be made slowly, as sudden distension of the joint is very painful. This is particularly true in the case of children, whose joints are not fully developed and hold only a small amount of gas. I have not found it necessary, or of any value, to measure either the volume of gas injected or the pressure used. The injection should be made very slowly until the joint has become definitely enlarged, and then stopped. There is usually some discomfort during the injection, but I have not yet been obliged to administer any sedatives. It might, however, be advisable to give a small dose of morphine or codein in very nervous patients. The average time of injection is about one to two minutes. The knee, shoulder and finger joints are easy to inject. The elbow I have found difficult to enter and more difficult to inject. I have had no experience in the injection of the hip or ankle joints.

It is much more difficult to inject the joints of children than those of adults, chiefly because of the diminished capacity of the former. Joints that have been distended as a result of synovitis or arthritis are easily injected, and they hold a fairly large quantity of the gas. The oxygen may remain in the joint for several days. In some cases it disappears in as short a time as 18 hours; in others it remains as long as 72 hours. In the average case the gas escapes or is absorbed in 36 hours. I have not tried deflation as practiced in pneumo-peritoneum. Some of the gas, as the pictures show, escapes into



the subcutaneous tissue and intermuscular planes, but it does no harm there. There have been no ill-effects whatever from the use of oxygen in any of our cases. With the exception of the case of subdeltoid bursitis, all patients have been kept in bed until the gas disappeared. This may be an unnecessary procedure, but I had no precedent to guide me and felt that for weight-bearing joints, particularly, complete rest would help to avoid untoward changes.

Up to now the joints have been prepared by thoroughly scrubbing the skin with soap and water just as for a major operation. In knee cases the patient has been kept in bed at least 24 hours before the injection. At the time of injection the skin is painted with iodine. These precautions may prove unnecessary. My experience coincides with that of other observers, that anesthetization of the skin is not required. Having determined the location and direction for the injection, the needle can be thrust into the joint so rapidly that there is no more pain than in an ordinary hypodermatic injection. The needle should be held firmly when in the joint, as moving it may scratch the synovial membrane or bone, both of which are very sensitive. In order to avoid the escape of too much of the oxygen before the pictures are taken, the injection should be made in the x-ray laboratory.

#### CONCLUSIONS.

When I first began my work with the injection of oxygen into joints I was hopeful that this method would enable me to outline loose or injured semilunar cartilages. In this I have been unsuccessful, although on one occasion shadows were obtained which appeared logically to outline these structures.

However, in reviewing my experiences, there is no doubt that the injection of oxygen into joints for roentgenography has many advantages and is a great aid in diagnosis. Primarily it accentuates the contrast between the soft parts and bones, and brings into relief soft structures that are not discernible in the ordinary roentgenograms. It is very useful in demonstrating loose bodies in joints, and it is invaluable in locating them. It is helpful also in showing the presence and extent of hypertrophied synovial tissue.

I WEST 85TH STREET.

Very often the unskilful treatment of a fracture is worse than no treatment at all. Serious deformities may result from the neglect of small details no less than from the violation of important principles.

## THE TREATMENT OF JOINT TUBERCULOSIS.

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SAN FRANCISCO.

The treatment of joint tuberculosis shows much difference of opinion, and, as in other diseases in which this condition exists, so here the difference of opinion must rest upon ignorance of fundamentals. Either we all are ignorant, or some of us are ignorant. As long as the treatment of a disease rests purely on clinical experience for its authority, it is bound to be diversified and to change from day to day, for one man's clinical experience is about as good as another's, and his opinion this week is quite different from his opinion next week.

As an example of this, let me quote the case of appendicitis. Before its pathology was known, its treatment was most diversified. With a knowledge of its pathology came a rational treatment, and gradually a standard method of procedure was adopted. Today many men differ somewhat in details of procedure, but no intelligent surgeon attempts to cure the disease with external applications, or by exposing his patient to the sun's rays, or by opening the abdomen and blindly scooping around with a curette. These and many other methods of treating joint tuberculosis will probably disappear when the pathology of the disease is understood. In one part of the country in which I resided for a while the standard treatment was amputation. After I had had a chance to watch for a while the other methods of treatment to which patients were exposed, I was quite willing to concede that in that section of the country the patient who had his limb amputated was about the only one who stood much chance of pulling through!

The pathology of joint tuberculosis as it appears in the text-books is partly mythical and partly a rehash of positive statements made years ago by surgeons of enough reputation to "put them across". Anyone with ordinary intelligence, who is willing to work in a laboratory for a few months can overturn the whole edifice. Let us erect a framework of pathology, and then let us see if we cannot place upon it a habitable edifice of treatment.

Tuberculosis of a joint is the same in its essence as tuberculosis in any other part of the body. It usually starts in the bone, and the peculiarities it enjoys are due to two things: It runs its course locked up in a bony shell; and it usually has in its immediate vicinity a closed cavity, the joint.

Pure joint tuberculosis, that is, tuberculosis not



complicated by the presence of a secondary infection by pus germs, is a disease strictly limited to two tissues, lymphoid marrow and the synovial membrane. The disease may start in either one, and later may involve the other, or it may remain indefinitely in one of them alone. If it remains in the marrow and does not involve the synovial membrane, it is, strictly speaking, not a tuberculous arthritis, but simply a tuberculous osteomyelitis, but in point of fact, if it ever attains sufficient importance to cause clinical symptoms, it almost invariably does involve the joint. It seems to seek the joint as if with a well-defined purpose, and nature's whole protective reaction is in the direction of depriving the joint of function, in other words, of destroying it. This she is very rarely able to do unaided.

Tuberculosis exists in the neighborhood of the joints in the long bones, that is in the ends of the long bones, simply because there the marrow is of the lymphoid variety. Except in young children, the marrow in the shaft consists of little else than fat, and, as is well known, fat is but a poor food or culture medium for the tubercle bacillus. All the world over every living thing domiciles itself where its food supply is best, and all through the body we find that the lymphoid tissues are the great feeding ground of the tubercle bacillus. This is the reason why tuberculosis is found in the spongy ends of the long bones and not in the short and flat bones throughout the body. Simplicity is probably responsible for the failure of recognition of this fact hitherto. It is so much more attractive to speak of rapid or slow blood stream, of congestion following injury (as if the bone or its contained marrow could possibly be injured by anything but a fracture!), of peculiarities in the arrangement of the bloodvessels, or of the "pars minoris resistentiae".

The presence of the lymphoid marrow in the region of the joint seems to depend, at least in the adult, largely upon the presence of function in the joint. The presence of the synovial membrane depends absolutely upon the presence of joint function. When function is destroyed, these two tissues disappear. When they disappear, the disease dies out. It dies out simply because its food supply has ceased. It is starved out. Here we have our first great rule of treatment: **DEPRIVE THE JOINT OF FUNCTION.**

This rule has two corollaries:

1. *In children*, while the presence of the lymphoid marrow may be somewhat dependent upon function, it is not absolutely so. The disease can exist

in the shaft as well as in the end of the bone. Radical operations are not, therefore, invariably successful and, on the contrary, often they entail crippling and unsightly deformities, on account of their interference with the centers of growth. Conservative treatment offers a faint chance of cure and is easily carried out. Therefore the treatment of joint tuberculosis in children is almost invariably conservative. We carry it out until they have at least almost attained their full growth, or until all hope of saving the limb is gone. In the latter case we amputate. Conservative treatment consists first and foremost of immobilization. Other means such as heliotherapy, passive congestion, etc., are auxiliary.

2. *In the adult* the case is entirely different. In spite of all extravagant claims of wonderful cures by various means, the presence of tuberculosis in the region of the joint, of sufficient severity to cause clinical symptoms, means that painless function in that joint is doomed. By conservative treatment, always difficult to carry through in the adult, we may at length succeed in securing a fibrous ankylosis, and in the fibrous adhesions tuberculous foci will be locked up, ready to be set free at any time, even after many years, and start up the whole disease afresh. In other words, the best we can obtain is a stiff and sometimes a painful joint, after years of conservative treatment. We can obtain in a few months a stiff, painless joint, and one in which the disease is permanently cured by radical treatment. Therefore we say, in adults the treatment is almost invariably radical as soon as a positive diagnosis is made. When we operate, we do so, not with any idea of removing much or little tuberculous material, but with the definite purpose of destroying function in the joint, completely and permanently.

When we speak of a positive diagnosis, we mean exactly that and nothing less. No man living can make a positive clinical diagnosis with the aid of the roentgen rays or without it. The demonstration of the tubercle bacillus is the only sure criterion. The demonstration of the bacillus is not practicable in disease of the spine, but fortunately the diagnosis here is more apt to be correct than in the other joints, and we are justified in going ahead on a strong presumption, especially as ankylosing operations entail little interference with the function of the spine as a whole. In other cases the demonstration is quite practicable.

So much for the first great rule.

We have seen that bone and joint tuberculosis is strictly a disease of the lymphoid marrow and of the



synovial membrane. It is in itself a comparatively harmless disease, entailing practically no constitutional disturbance, and with little danger to life unless in the spine it interferes with the functions of the cord. With the advent of a secondary infection the whole picture changes. Tissues previously immune immediately become vulnerable, and instead of a strictly localized, comparatively harmless disease we have to deal with a widespread and a very dangerous one. From this fact we draw our second rule: AVOID SECONDARY INFECTION.

All operations upon tuberculous joints are to be conducted with the strictest asepsis, and when the operation is finished, the wound is to be closed without drainage. The practice of scraping, packing and draining tuberculous joints is responsible for the loss of thousands of lives. Every effort must be expended to prevent the establishment of a communication of the focus in the bone with the outside air. When we attempt to provide by drainage for the exit of tuberculous material we really provide for the entrance of pus germs, and often open the door through which death eventually enters.

The importance of the third rule is generally well understood and needs no emphasis here. In the long run the outcome of the case depends largely upon the resistance of the patient to the disease, and anything that improves his general health makes the prognosis more favorable. Hence the third great rule in the treatment: IMPROVE THE PATIENT'S NUTRITION.

Probably the vogue of sunlight treatment depends in the last analysis upon its favorable influence on the general health. When the patient is exposed to the sun's rays he is also in the fresh air. A few years ago the seashore was being boomed just as enthusiastically as are the mountains of Switzerland today. It always seems necessary to "camoufler" sunshine and fresh air in order to persuade the human race to avail itself of their benefits. The patient should be in the open air as much of the twenty-four hours as possible. A child should remain out of school for at least the early stage of the disease. An uninfected tuberculous joint carries a very small danger to life, but its presence shows ordinarily the presence of a tuberculous focus somewhere else in the body, a focus that may eventually be the cause of death, even after the joint is well.

Conservative treatment consists usually in immobilization, either with some sort of brace or with plaster-of-Paris. Some surgeons prefer one, some the other. Each has its advantages. It is quite useless to apply plaster, or a brace, for that matter, reaching

a few inches on each side of the joint. A plaster dressing for the elbow should reach from the axilla to the wrist, one for the knee from the perineum to the malleoli, etc. Bony prominences must of course be padded, but padding is quite unnecessary over muscular bellies, and is out of place there, for with it the dressing can not be made to fit snugly.

When immobilization is begun with a tuberculous joint, one must realize that the treatment must be continued for a year at the very least, almost always for two years, and usually for three or four.

Cold abscesses, if deep seated, not increasing rapidly in size, and not approaching the surface, may be let alone. Otherwise they should be aspirated with a large needle or a trocar, under the strictest asepsis. When they refill they must be aspirated again, but the needle must not be thrust through the same spot in the skin. Some surgeons advise the injection of the cavity of the abscess with some antiseptic, usually a preparation of iodine, but whether or not this is wise it is hard to say. In no circumstances must these tuberculous or cold abscesses be opened and drained. If they are, they will invariably become infected, and will give rise to sinuses that may remain open for years, and eventually be the cause of the patient's death.

In operating upon a tuberculous joint one must remember that the object of the operation is not to remove all the tuberculous tissue. This is quite unnecessary, and more, it is quite impossible. There is no way in which any one can assure himself how far the disease extends in the bone. The operation should be planned with the sole idea of destroying the joint. A small slice is to be removed from the end of each bone of the articulation, the bone ends are brought accurately into apposition, and then are held in close apposition and immobile with plaster-of-Paris or a splint.

In closing the wound it is wise not to approximate too exactly the skin edges, otherwise the inevitable oozing of blood from the bone may give trouble. The plaster dressing may be left on for six weeks or longer. In the absence of infection the wound does not need to be dressed. Because there is no periosteum in the region of the joint, bony union at the seat of the resection is very slow. Usually it takes about a year, but in the knee of the adult the tight fibrous union gives a reliable result after about six months.

Bony union is easy to secure in the knee, but difficult in other joints. In the elbow, bony union does not ordinarily result from a resection. In the wrist,



instead of the customary resection, a graft should be run between the distal end of the radius and the proximal end of the third metacarpal. In the hip, the head of the femur should be removed and the trochanter thrust into the acetabulum. The hip should be put in plaster in moderate abduction for several months. In tuberculosis of the ankle, the talus may be removed, the malleoli freshened, and the foot subluxated somewhat backward (Whitman operation). In tuberculosis of the spine, the best operation is the Hibbs operation, but it is rather difficult, and most operators are content with the Albee operation with the bone graft. It is seen that in neither of these operations does the surgeon work upon the bone in the diseased area, yet cure ordinarily results. Operation is almost invariably the best treatment for tuberculosis of the spine in patients of all ages. Conservative treatment rarely results in cure, and deformity is almost impossible to prevent by conservative treatment.

1. DEPRIVE THE JOINT OF FUNCTION.
2. AVOID SECONDARY INFECTION.
3. IMPROVE THE GENERAL HEALTH.

STANFORD MEDICAL SCHOOL.

### BOW-LEGS AND OTHER RACHITIC DEFORMITIES.

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The most common deformities of children resulting from rickets are bow-legs, knock-knees and anteriorly bent tibias. Rachitic deformities usually reach their highest development during the second or third year and the deformities of the bones become firmly established in the eburnizing or hardening stage that follows.

In the early stages of rickets, and before eburnation of the bones, the deformities may be corrected by putting the legs into plaster-of-Paris and holding them in corrected positions with mild manual force until the plaster sets. The child should be encouraged to walk in the plaster for three weeks. Repeat the procedure if necessary. Perfect corrections, especially of bow-legs, can frequently be made by this process.

With eburnation the bones become much denser and harder than when normally ossified and then the deformities can be corrected only by osteoclasia or osteotomy.

Contrary to a quite prevalent opinion that these deformities are produced by too early walking, the

most viscous deformities are frequently seen in children that have been so weakened by rickets that they have never walked or even stood alone.

Under favoring conditions of a vitamin-rich anti-rachitic diet, fresh air and cleanliness supplemented by phosphorized cod liver oil, the rachitic symptoms will usually disappear in from one to three months. With the cure of the rickets the bones usually eburnate quite suddenly.

Non-unions after accidental or spontaneous fractures, which are so frequently seen in the fragile bones of acute rickets, are a constant warning against either an osteoclasia or an osteotomy until eburnation is complete.



Fig. 1. (Case I). Boy, aged 5 years, with badly deforming rachitic bow-legs.

The rules for the roentgenographic differential diagnosis of the three stages of rickets that have been given by Robert N. Lovett\* should never be neglected. In the acute stage the roentgenogram shows the epiphyses of the tibia clouded and blurred, and the ends of the diaphyses presenting a frayed-out appearance. In the subacute stage the shadows begin to clear. With the eburnation the normal roentgenographic clearness and regularity of outline returns, and not until then should any corrective operation be attempted.

Figure 2 shows a roentgenogram of the out-bent tibias of bow-legs after eburnation. They are more

\*Lovett, Robert M. Section on Orthopedic Surgery of the A. M. A., 1915.



dense and hard than normal bones. The ends of the epiphyses are broadened and lipped next to the epiphyseal line, but the lines are clean-cut and clear showing that the bone is ready for osteoclasia or other operative measures.

It is very important that the Gratton osteoclast be rightly used to get the best results. For the correction of bow-legs the procedure is as follows: After anesthetization, the fracturing bar is placed against the outside of the leg on a level with the peak of the deformity and about midway between the retention bars. (See positions in figure 8.) Any interne may turn the screw, with instructions to screw down and to release with the utmost rapidity when so directed. The operator holds the leg in posi-

the knee with one hand and the thigh with the other against the retention bars, which insures the location of the lower retention bar on the condyle. After fracturing, the leg should be put into plaster-of-Paris from the floating ribs to the toes and in an over-corrected position, so that after the plaster sets it looks like a case of bow-legs.

For the correction of anteriorly bent tibias, the fracturing bar should be placed against the outside of the ankle and close to a level with the peak of the deformity. The fracture of the tibia should be complete and the correction of the deformity by opening up a triangular space in the posterior tibial shaft should be made by manual force and maintained until the plaster has set. This usually lengthens the



Fig. 2. (Case I). Roentgenogram showing eburnated tibias ready for osteoclasia.

tion against the retention bars with both hands. If either retention bar is placed near a joint, the position of the operator's hands will give him a timely warning against any possible slipping into a joint. The fibula always fractures with, or slightly before, the tibia. Immediately after fracturing, the leg should be put into plaster-of-Paris from the perineum to the toes and held in an over-corrected position so that when the plaster sets the legs look like a case of knock-knees. The plaster is usually removed in six weeks, and a week later, after a second photograph is taken, the patient is discharged cured.

For the correction of knock-knees, the fracturing bar must be placed against the inside of the thigh just above the inner condyle. The operator holds



Fig. 3. (Case I). Shows the same boy six weeks after bloodless rapid osteoclasia with useful and symmetric legs.

leg 2.5 cm. To anticipate this lengthening of the leg, a tenotomy of the tendo achillis should be previously made to allow it to lengthen correspondingly. In cases of vicious twisting with 8 to 10 cm. of shortening of the tibias, I have repeated the fracturing and lengthening of the tibias with the accompanying tenotomy of the tendo achillis at different levels, three or four times, at intervals of three or six months. The dwarfed patient was usually as much pleased with a gain of 8 to 10 cm. in height as with the straightening of his crooked legs.

Ample experience shows that three or four lengthenings of the tendo achillis by simple division leaves its strength unimpaired. Experience also shows that the nerves and arteries do not suffer in the least from



10 cm. of lengthening if done 2.5 cm. at a time and three to six months apart.

Osteoclasis has many advantages over osteotomy for the correction of rachitic deformities. Better

is on the table only about one-tenth of the time that is required for an osteotomy with its attendant aseptic precautions and dressings.

Rapid osteoclasis is a good term to use, for slow



Fig. 4. (Case II). Girl, aged 5 years, with weak and deforming knock-knees, making walking difficult.



Fig. 6. (Case III). Girl, aged 5 years, with deforming out- and anterior-bent tibias.



Fig. 5. (Case II). The same girl six weeks after bloodless and rapid supracondyloid osteoclasis with useful and symmetric legs.



Fig. 7. (Case III). The same girl six weeks after rapid osteoclasis with tenotomy of the tendo Achilles and showing symmetric and useful legs with 2.5 cm. of lengthening.

symmetry is obtained with osteoclasis. With six to eight seconds for the osteoclasis, eight seconds for the manual correction and eight minutes for applying and setting of the plaster-of-Paris, the patient

osteoclasis is dangerous. The Grattan osteoclast is by far the best instrument to use for this purpose.

The best age for osteoclasis is from three to six years. Under three years the bones will usually be



too soft, and over six years too hard, for osteoclasia. In children over six we use osteotomy with the usual antiseptic precautions, but as most of the children presented for correction are of the right age, osteoclasia is used in a great majority of the cases at the Hospital for Destitute Crippled Children, Chicago. This hospital has had a world record for the bloodless correction of rachitic deformities, as can be readily shown by photographic and other records.

Before the late war with Germany, every year Chicago received over seventeen thousand new immigrants from Italy, Greece, Syria and other tropical or semi-tropical countries. None of the children that came in the mother's arms or holding to her

on starvation milk. When the Chicago-born baby gets to be two or three years old, it is brought to the hospital, a bundle of vicious rachitic deformities. After about seven years the mothers from tropical countries become adapted to their new homes and also reach some degree of prosperity. Then they produce no more rachitic babies.

The children born to Russian, German and Polish Jewish mothers under exactly the same conditions of immigration and living as the Italian, Greek and Syrian people do not develop rickets and rachitic deformities. This fact has caused much speculation, but is easily explained. The northern mothers are acclimated to cold winters and are familiar with diets that prevent scurvy and that equally well pre-

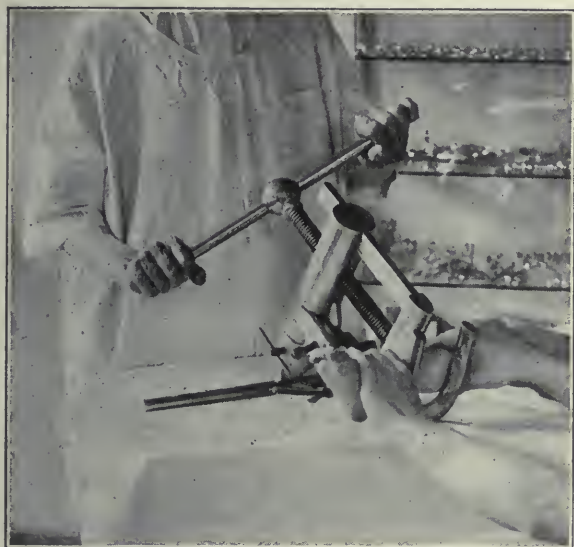


Fig. 8. The Grattan osteoclast in position to fracture the tibia and fibula, with the fracturing bar against the outside of the leg for the correction of bow-legs or anteriorly bent tibias. The retention bars are against the inside of the leg and the operator's hands are grasping the leg close to the retention bars.

skirts developed rickets, but 80 per cent of the first Chicago-born children did develop rickets of the viscously deforming types. The explanation is easy. The poor Italian, Greek and Syrian mother lives at home almost in the open with a diet of fresh fruits, milk and other uncooked foods. When the baby is weaned, it has the same vitamin-filled, anti-rachitic diet. These mothers live through their first winters of Chicago's snow and ice in squalid back-rooms. The families frequently sleep on the floor with a little stove in one corner on which is a kettle containing a ten-cent soup bone and water. This poor excuse for a soup with the addition of a loaf or two of the cheapest bread serves the entire family for several meals a day. The mother gets home at night from a scrubbing job and nurses her baby



Fig. 9. The Grattan osteoclast in position to fracture the femur with the fracturing bar just above the inner condyle for the correction of knock-knees. The lower retention bar rests close to the lower edge of the outer condyle and its position is guarded by the operator's hand.

vent rickets.

Fear has been expressed by operators not familiar with the Grattan osteoclast that when used close to a joint "it may slip over the end of the bone into the joint". I have never seen a joint in the least endangered by the use of the Grattan osteoclast.

In the case shown in figure 6, the deformities will be seen to be very close to the lower ends of the tibias and the osteoclasts were done as close to the ankle joints as one could desire to do osteotomies. In the case shown in figure 4, the supracondyloid osteoclasts were done quite close to the condyles. In neither of these cases were the condyles in the least danger.

I have never had a non-union following osteoclasia, and the only one that I have known to occur was in



the hands of a careful operator and it antedated Lovett's rule for determining eburnation, or it would not have happened.

Non-unions following osteotomy are of frequent occurrence and are undoubtedly due to the interruption of bone continuity by the chisel and the filling of the open space by extraneous materials.

It is the position in which the legs are placed in plaster-of-Paris after osteoclases that determines both the anatomic and the functional results.

Osteoclasia has proved to be remarkably free from complications. No nerve injury or fat embolism has ever been observed.

15 E. WASHINGTON ST.

### THE IMPLANTATION OF TENDONS.

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The transplantation and the fixation of tendons are now firmly established by experience as useful surgical procedures. There persists, however, a great deal of dissatisfaction with both methods of treatment owing to the variability and uncertainty of the results obtained. A review of a large number of patients treated by these methods in various American and British clinics would appear to show that a large proportion of the unfortunate results have arisen from poor discrimination in the choice of patients. Many surgeons, after deciding to give a certain method of treatment a trial, apply it more or less generally to the next thirty or forty cases that present themselves, without much consideration of its applicability or limitations. Thus one frequently sees the tendons of comparatively weak muscles transplanted with the idea of replacing the lost function of muscles whose action must be powerful to be at all useful. An example is seen in the transplantation of the peronei to replace a paralyzed triceps surae. Similarly, one sees tendon fixations performed without a preliminary correction of the skeletal deformity, with the result that the deformity persists after the splints are removed, exactly as it was before the operation, or as it existed on the operating table immediately after the fixation had been performed. It is clear, therefore, that in these as in all other useful operative procedures, much of the dissatisfaction is unjustified owing to the poor judgment of the operators in choosing their patients, or to their lack of appreciation of the principles which must be clearly understood before a method is placed on trial.

Besides the group of poor results which can be attributed to these errors, however, there remain a considerable number in which the cases appear to have been well chosen and the principles involved in the treatment thoroughly understood. We have observed many tendon transplantations that have appeared to be successful for a time, which have ultimately proven to be failures owing to the separation of the tendon from its new point of insertion. Similarly, in tendon fixations, it is common experience to find that soon after the patient begins to use the limb, the supposedly fixed tendon breaks loose from its point of attachment and the deformity reappears as before. When such results are considered along with those in which the implantation of the tendon has remained permanent, it is clear that the variability of the results must be due to differences in operative technic. It was with a view to determining the essentials in this technic that the following short investigation was undertaken.

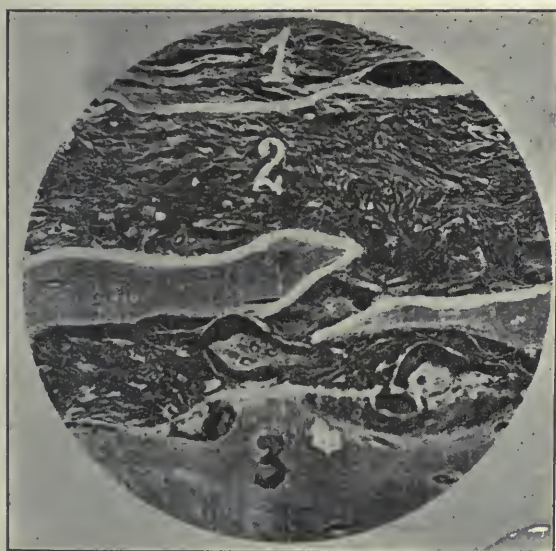
Our attention was first directed to the subject shortly after the publication of our first papers on "Tendon Fixation" in 1913.\* Several patients reappeared in the clinic several months after the operation, with a complete recurrence of the deformity. These included a case of varus in which a fixation of the peronei had been performed, a case of calcaneus in which the tendo achillis had been fixed, and a case of valgus in which an attempt had been made to correct the deformity by fixing the tibialis posticus tendon. When the plaster bandages were removed two months after the operations, the feet were in excellent position, and the adhesion of tendon to bone seemed firm. Yet with a month or more of ordinary walking the tendons appeared to be as movable as before operation. These patients were immediately subjected to a second operation and it was found that in each case, although the tendon lay in a groove in the bone, this groove was lined with areolar tissue that closely resembled the ordinary areolar sheath of normal tendon. Any adhesions that did exist between the tendon and the bone were long and slender and offered no resistance to recurrence of the deformity. The original technic employed consisted of roughly exposing the tendon and burying it in a groove cut in the bone, and, after drawing it taut, fastening it in place with absorbable sutures. This technic was now changed and attention was directed towards the complete removal from the tendon of all areolar tissue, and the result was a

\**Annals of Surgery*, March 1913. *Journal of the American Orthopedic Association*, July, 1913.



marked improvement in the percentage of successes obtained.

There remained, however, a small proportion of cases in which the tendons seemed to pull loose, and second operations performed on these patients showed that the failures had resulted from stretching of the scar tissue that united the tendon to the bone. In some instances large areas of the buried tendon were glistening as at the time of the original operation and the adhesions were scanty and very weak. Before we had reached this stage in our observations we had begun to employ the operation of



High power photomicrograph of a longitudinal section of a tendon which had been fixed in a trough in the bone one year previously. The borders of the various structures are indicated diagrammatically by white lines drawn on the photograph. 1. Longitudinal section of tendon. 2. Fibrous tissue uniting tendon to bone. Note the irregular arrangement of the fibers as compared with the parallel arrangement in the tendon. 3. Bone.

tendon fixation in patients in whom the muscles were only partially paralyzed, but in whom deformity had developed. In these cases only half of the affected tendon was buried in the bone and the remaining half left to carry out its ordinary function.\* In no case so treated have we ever observed a recurrence of the deformity. This observation suggested that more certain union might be obtained by placing the cut surface of the tendon in contact with the bone instead of the superficial surface. The technic was accordingly modified and the tendons thoroughly scarified and split longitudinally before being laid in the groove. More recently, the probability of solid union has been increased by forcing some of the chips of bone removed in cutting the groove among the strands of the split

tendons, before closing the periosteum over them. Since this technic has been employed we have seen no cases of failure to obtain solid union of the tendon to the bone.

Some surgeons have supposed that more certain union can be obtained by cutting the tendon free from the muscle and threading it through a hole in the bone. Our investigations have shown that this is a mistake, however, as recurrences of deformity develop quite as frequently after this technic as after that described. This is but natural as the principle involved is the same in each case. If it is preferred to thread the tendon through a hole the same precautions must be observed in removing the areolar sheath and in placing raw surface of the tendon in contact with the bone, otherwise a high percentage of failures will result.

The histological changes produced by such operations have been carefully observed both in humans and in animals. Tendons are composed of parallel white fibers arranged in bundles which are separated by a minute amount of areolar tissue which carries the bloodvessels and lymphatics. These septa of areolar tissue pass into the tendon from a delicate sheath which covers its surface. Between the parallel fibers lie the tendon cells. When a tendon is injured, as in a simple tenotomy or in splitting it longitudinally, it undergoes the ordinary inflammatory reaction associated with repair. The bloodvessels in and about the injured part become engorged and an exudate occurs which produces the usual edema and infiltration with inflammatory cells. Cellular proliferation goes on in the line of the wound, and ultimately healing occurs by the production of an ordinary scar. In the process of repair, however, the tendon cells and the fibers appear to take no active part, as the edges of the wound remain clean-cut throughout, and no proliferation can be seen in the tendon cells themselves. The cellular proliferation appears to arise from the areolar tissue on the surfaces and among the bundles of fibers. Moreover, the scar that is ultimately produced does not resemble normal tendon at any stage up to six months after operation, which was as long as we continued to recover specimens. The fibers are thinner, more loosely arranged, and do not assume the parallel arrangement to which tendon owes its great strength. It is evident, therefore, that wounds of tendons heal by means of a tissue which is really ordinary scar tissue and which has the defects of such tissue in that it will readily stretch when subjected to strain. This has been clearly

\**Annals of Surgery*, July 1914.



demonstrated clinically in the operation of transverse subcutaneous tenotomy. This operation has been practically abandoned, owing to the stretching which so frequently occurs in the scar that unites the cut ends of the tendon.

When it is realized that the healing of tendon to bone or of tendon to tendon depends on ordinary scar tissue, it is clear that if the union is to be strong enough to withstand high degrees of strain, it is not only essential that we shall make certain of the formation of tough scar tissue by placing raw surfaces together, but also that we shall place these surfaces together over considerable distances. This principle has been adopted in the various tendon-splitting operations employed in the lengthening of tendons, but its importance has not been appreciated in tendon fixations and transplantations or in the ordinary suture of severed tendons. While a simple end-to-end suture may sometimes be quite sufficient in a wound of such a tendon as the extensor indicis, where the strain will be very slight, it will prove quite inadequate in wounds of the flexors of the hand and wrist or the powerful flexors of the foot. Similarly, many failures in tendon fixation and transplantation can be attributed to the smallness of the area of contact of the raw surface. When it is intended to unite tendon to bone or tendon to tendon, the surgeon must keep in mind the degree of strain to which the points of union will be subjected, and prepare the part to be sutured accordingly. For example, in fixation of the peronei it is sufficient to bury the split and scarified tendon in a tunnel about two inches long, but if it is intended to fix the tendo achillis, it must be buried for three or four inches. Similarly, in the transplantation of tendons, the distal end of the tendon, after being split and scarified, must be threaded through a hole in the bone sufficiently long to ensure abundant scar formation. Nothing is more futile than the suturing of the end of a tendon to the periosteum or the fastening of it into a small groove in the bone. As soon as strain is applied the tendon pulls out and the whole operation fails. The same rule applies in the suture of tendon to tendon.

Great advance has been made in recent years in the treatment of limbs that have sustained irreparable injuries to nerves. Nothing could be more brilliant than the results that have been obtained from transplantation of flexor tendons of the forearm to assume the function of the extensors that have been paralyzed by gunshot wounds of the musculo-spiral nerve. But many of the operations have been

failures, or only partial successes, owing to stretching of the scar at the point of union of the tendons. To reduce the element of chance in these operations, some surgeons have advocated the use of silk or linen sutures. Such materials, however, have the well known disadvantage that they are apt to produce irritation, even weeks after the operation, sufficient to necessitate their removal. Moreover, there is no reason to believe that a non-absorbable suture will assist materially in the permanent union of such structures, for there are abundant examples of their cutting out under ordinary degrees of strain. At any rate, their use is quite unnecessary, as there is no difficulty in inducing tendons to heal together firmly if raw surfaces are placed in contact over a sufficient distance. A most convenient and certain method of doing this is to splice or braid one tendon into the other as in splicing a rope. If this is done over half an inch in a small tendon as the extensor longus pollicis, or over an inch or more in a larger tendon such as the extensor carpi radialis, and ordinary absorbable sutures are employed, solid union can be confidently anticipated.

The views herein expressed have been developed from observation of many operations on tendons and from a series of experiments on animals, a partial report of which has already been published.\* They may be summarized as follows:

1. Wounds of tendons heal by ordinary scar tissue which is produced by the areolar membranes on the surfaces and the connective tissue trabeculae which separate the bundles of fibers.
2. This scar tissue, when subjected to strain, is liable to stretch or break unless it is present in considerable quantities.
3. To unite tendon to bone as in tendon fixations or transplantations, it is necessary to place it in close contact with the bone over a considerable distance in order that the scar tissue may be strong enough to withstand the anticipated strain. It is also necessary to remove all the areolar membranes from the surface and it is preferable to split the tendon in order that the raw surface may come in contact with bone.
4. To unite tendon to tendon it is necessary to place raw surfaces in contact over sufficient distance to ensure the required strength in the scar. This may be conveniently done by braiding or splicing one tendon into the other.

143 COLLEGE STREET.

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\**Canadian Medical Association Journal*, July, 1921.



THE FREE TRANSPLANTATION OF  
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The surgery of the free transplantation of tissues has made rapid strides within the past twenty years. During this time free transplantation of bone has passed out of the experimental stage and has become one of the recognized surgical procedures, almost as safe as a gastro-enterostomy. The technic of the free transplantation of tendons has not yet reached this stage of development, but it, too, has made a big advance. The very fact that there is still much to be done before it can be considered a finished surgical procedure renders the subject one of double interest to all who are engaged in reconstruction surgery. When one considers that scarcely eight years ago Wilhelm Müller of Rostock could only express the hope, till then unbased on fact, that future surgery might be able to replace the loss of tendons by free transplant, and that within these eight years a method has been found that renders this operation feasible in a high percentage of cases, the progress of this particular phase of surgery is evident.

Lexer has unquestionably done more abroad than anyone to further this development. In our own country I should place first the name of Sterling Bunnell, of San Francisco, whose work in this particular field is all too little known to the medical profession. In 1918, in a short article in *Surgery, Gynecology and Obstetrics*, he published a report of some of his operations and described a technic which in its simplicity and ingenuity at once impressed me as being superior to that used in any clinic either here or abroad. The essential in the Bunnell method is the principle of non-traumatism; the tendon must be regarded as an exceedingly friable tissue and every attempt must be made to retain intact the gliding cells whose importance had already been emphasized by Biesalski and Mayer. To facilitate the suture of the transplanted tendon, Bunnell devised a special clamp, so constructed as to hold the tendon fibrils firmly together during the application of the suture, instead of disrupting them as usually occurs when the tendon is grasped with the forceps. By the use of this clamp and by other refinements in the technic, Bunnell was able to report a number of instances in which total loss of the flexor tendons of the fingers had been successfully replaced, even to the extent of restoring almost the full motion of the injured phalanges.

Until the appearance of Bunnell's article, my own experience with tendons had been confined almost entirely to the pedunculated transplant, or what might be better termed the transfer of tendons. In the pedunculated transplant the tendon is left attached to the muscle and the operation consists merely in changing its point of attachment. Thus in utilizing the peroneus longus tendon to replace the paralyzed tibialis anticus tendon, the peroneus longus is divided where it grooves the cuboid bone and, after lifting it from its bed, it is simply shifted from the outer side of the foot over to the inner and attached to the internal cuneiform. In this procedure, if the operator has a knowledge of the blood-vessels of the tendons, the main nutrient artery can almost always be preserved intact and the vitality of the transferred tendon is thus assured.

In the free transference of tendons the problem is rendered much more difficult, since the blood supply must be entirely destroyed and the vitality of the transplant is thus dependent on the accuracy of the coaptation of tendon to tendon and upon the delicacy with which the transfer is made. Whether the tendon lives in part or whether part of it necroses is a question which still awaits positive answer. Gallie and LeMesurier in a recent paper before the Orthopedic Congress in Boston, June 4, 1921, reported that in their researches the nuclei of the transplanted tendons invariably retain their staining properties and gave every evidence of escaping necrosis. Other observers (Neuhof) incline to the view that all transplanted tissue dies and is replaced by the activity of the surrounding tissues. Whatever the actual fate of the tendon cells may be, certain it is that clinically a tendon can be transplanted and that it can function without any evidence of losing its vitality.

The laws that have already been enunciated for the successful performance of a tendon transfer (pedunculated transplant) apply with even greater force to the free transplantation. The primary consideration is a knowledge of the anatomy and physiology of tendons and an attempt to reconstruct, so far as possible, the normal gliding mechanism (see Mayer, *Physiological Method of Tendon Transplantation, Surgery, Gynecology and Obstetrics*, February, March, April, 1916). In brief, the tendons are normally equipped with a distinctive gliding mechanism. Where the tendon is running a straight course, this consists of an investiture of loose areolar tissue peculiarly rich in elastic fibers, to which I have applied the term "paratenon". This



tissue, lying between the tendon and the fascia, permits a free gliding motion of the tendon. Where the tendon changes its direction, this tissue would not suffice to prevent friction, since the tendon would impinge against bone or restraining ligaments. It is therefore at this point that a sheath surrounds the tendon. The sheath is a sack filled with fluid and acts as a buffer to diminish the friction. At the upper pole of the tendon a valve-like structure is invariably present which closes off the tendon sheath and at the same time permits the free to-and-fro motion of the tendon. This structure is called the "plica". The surface of the tendon is coated with cells which morphologically and functionally differ from the cells of the deeper strata. These superficial cells, frequently resembling cartilage cells in their morphology, seem intimately concerned with the gliding function, since their removal invariably causes adhesion. Injury to them must therefore be avoided wherever the gliding function should be maintained; they must, on the other hand, always be removed when the operator desires to cause fixation of the tendon either to the bone or to some other tendon to which it is to be spliced.

An adequate conception of the method and application of free tendon transplantation can best be gained by the description of a number of typical cases.

CASE I. Jean K., aged 4, while walking through a hay field was run down by a mowing machine which almost amputated both legs. The left was cut across about 3 inches below the knee, the right about 1 inch above the ankle. All the bones and the anterior soft structures were completely divided and the legs were left hanging by the posterior muscles only. Despite severe hemorrhage the child's legs were saved. When first seen by me four months after the accident the bones, though still ununited, showed signs of callous formation. There were several discharging sinuses leading down to small sequestra. Both feet were in a position of extreme equinus owing to the division of all the anterior muscles. The child was unable to walk. After several preliminary bone operations to remove sequestra and secure an aseptic field, the following free tendon transplantation was performed on the right foot.

Through a curving incision on the dorsum of the foot with its convexity towards the toes, the distal portion of the tendons of the tibialis anticus, extensor proprius hallucis and extensor longus digitorum were exposed. The skin flap was retracted upward and the tendons dissected upward until the severed ends were found bound by scar tissue 1 inch below the ankle joint. Through a corresponding curved incision 2 inches above the ankle joint with its convexity towards the knee, the muscle bellies of the

three injured muscles were exposed and traced downward until their tendon ends, which had been severed by the mowing machine, were dissected free. In each instance a slight amount of tendon was still found attached to the muscle fibers. The tendon ends were freshened so that healthy tendon fibrils were exposed. Between the proximal and distal tendon stumps was a gap of about 2½ inches. Using No. 1 chromicized catgut, the Bunnell stitch (see figure 1) was inserted into the proximal and distal stumps. As the extensor proprius hallucis was found extremely small, it was united to the extensor longus digitorum by means of this stitch. The next step consisted in boring two channels through the scar tissue at the ankle joint as nearly as possible in the location of the normal tendon sheaths. These channels were made by means of an appropriately

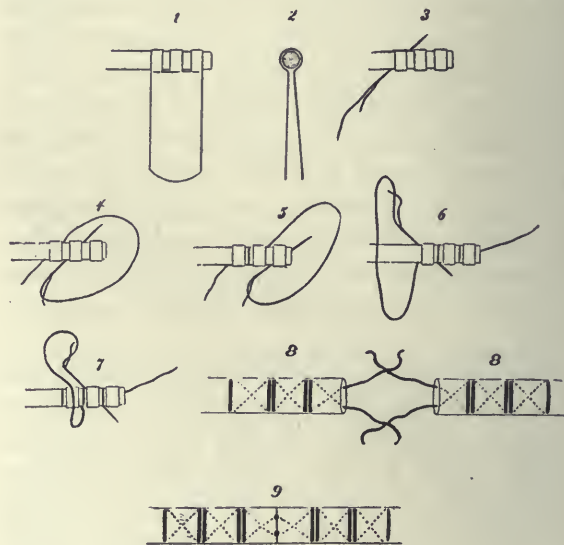


Fig. 1. Diagram illustrating the insertion of the Bunnell stitch. 1. The clamp applied, viewed from the side. 2. View of the free end of the tendon with the clamp applied. 3. Starting the stitch with the first needle. 4. Second stitch with the first needle. 5. Third stitch with the first needle. The needle emerges at the cut edge of the tendon. 6. Starting the first stitch with the second needle. 7. Second stitch with the second needle. 8. The stitches have been inserted into both tendon ends preparatory to knotting them. 9. The sutures have been knotted and the ends cut off short, bringing the tendons into accurate apposition.

shaped clamp and were sufficiently wide to permit the free passage of a tendon the size of the normal. The peroneus longus tendon was considered most suitable for transplantation purposes, since it alone would afford adequate length for the entire operation. It was exposed through a 6-inch incision running along the outer portion of the calf downward towards the cuboid bone. The tendon was cut just above the cuboid and the Bunnell stitch inserted into the lower end. Three inches of tendon were then measured off and at this point the tendon was again divided, lifted gently out of its bed, and by means of the chromic suture already inserted, it was drawn without any trauma downward through the channel already prepared for it, and its lower



end united to the distal tibialis anticus stump. To measure off accurately the correct length of tendon required, the foot was flexed to a right angle and the upper end of the tendon graft cut away until it exactly approximated the proximal tibialis anticus stump. This involved removing about half an inch. The Bunnell stitch was again inserted and united to the proximal tendon. In this way the reconstruction of the tibialis anticus tendon was accomplished. An exactly similar procedure was carried out for the two extensor muscles. The operation was completed by fine catgut continuous skin sutures. The leg was immobilized in plaster in the position of maximum dorsal flexion.

Immobilization was maintained for three weeks,



Fig. 2. Photograph illustrating the range of active motion eight months after the free transplantation of portions of the peroneus longus tendon to bridge a 3-inch gap between the divided dorsal tendons. The strength of the tendons is very nearly equivalent to the normal and the patient is able to walk without a limp.

then the plaster was cut down to form a bivalve splint and active exercises begun. Within a week the child was able to move the leg a trifle, and within a month there was  $10^{\circ}$  of active motion at the ankle. This has gradually increased until at the present time there is almost the normal range of motion (see figure 2). The leg is as strong as the normal and the child is able to walk without a limp. The transplanted tendons can be distinctly felt gliding to and fro at each muscular contraction.

CASE II. Mr. H., a druggist's clerk, severed the long flexor tendon of the right thumb near the base of the proximal phalanx. Owing to the "flu" epidemic and to deaths in his family, he was unable to give the finger suitable surgical attention, and

when seen by me two months after the accident, there was complete inability to flex the distal phalanx. The function of the hand was decidedly diminished. Examination of the muscles showed that the palmaris longus which would have been the tendon of choice for transplantation purpose, was absent. It was therefore decided to use a portion of the flexor carpi radialis in case a graft proved necessary. At the operation, which was performed under general anesthesia with an Esmarch bandage applied just below the elbow, the first incision was made over the lateral aspect of the distal interphalangeal joint and curved slightly near the tip so as to permit the retraction of a suitable flap. The distal stump of the flexor longus pollicis was found just proximal to the joint, only slightly adherent to the surrounding tissues. The tendon end was slightly fusiform and covered with glistening tissue resembling the normal gliding surface of the tendon. The end was freshened and the Bunnell stitch was inserted using No. 1 Pagenstecher linen. The proximal stump of the flexor longus pollicis was found through a 2-inch incision running downward from the annular ligament in the course of the tendon. It was seen to be much more densely adherent than the distal stump, but despite the adhesions, the course of the tendon sheath could be distinctly recognized and, instead of boring a passage, it was possible to pass a probe downward through the empty sheath and dilate it to the normal size by means of a curved dressing forceps. Between the tendon ends was a gap of  $2\frac{1}{2}$  inches. The proximal stump was threaded with Pagenstecher linen in the same way as the distal had been. The third incision exposed the flexor carpi radialis tendon above the annular ligament. It was found to be distinctly larger than the injured flexor longus pollicis. Accordingly the entire tendon was not used but two-thirds of it was split off longitudinally, the line of cleavage following one of the natural divisions of the tendon. The paratenon which normally covers this tendon was left intact. One end of the tendon was threaded with the Bunnell stitch and drawn downward through the tendon sheath and united to the distal stump, the upper end of the tendon was then accurately measured off to abutt against the proximal stump and united to it. The thumb was immobilized in complete flexion so as to take all strain off of the suture line. Active and passive motion were begun on the fourteenth day. About a week later the distal wound opened and one of the Pagenstecher sutures was extruded. Despite this, the motion of the transplanted tendon did not seem to be interfered with. Within two months the patient had almost the normal range of motion and within a year full function of the finger and hand had returned (see figure 3).

CASE III. Minnie C., a machine operator, sustained an extensive injury to the right hand which resulted eventually in necrosis of the extensor tendon of the fourth finger. The finger was held in the flexed position and could not be used at all. Amputation had already been advised. Even the action



of the lumbricals and interossei had been entirely destroyed by the infection. It was evident even before the operation that the entire common extensor tendon from the metacarpo-phalangeal joint downward almost to the distal interphalangeal joint was absent. The operation was conducted under general anesthesia with an Esmarch bandage applied just below the elbow. A 3-inch incision was made along the radial aspect of the fourth finger. As had been expected, the tendon was found entirely absent for a distance of two inches, that is, from the base

lying against the gliding surface of the fascia. A 2-inch incision was then made over the extensor tendons of the index finger. The more superficial of these, namely, the branch from the extensor communis digitorum, was threaded with the Bunnell stitch and attached to the proximal and distal tendon stumps which had previously been prepared by insertion of the corresponding sutures. The ends of the fascia were then drawn about the implanted tendon and sutured in such a way as to form a tube through which the newly constructed tendon could glide. A splint was applied holding the finger extended. Motion was begun on the fourteenth day. Owing probably to the complicated operation and to the unfavorable condition of the bone, the result of this case was not as perfect as in the first two, but enough gliding of the transplanted tendon occurred to demonstrate the feasibility of the method and to encourage me in the hope of greater success in the next case.

CASE IV. Mrs. G. This patient had a severe infection of the fourth finger of the left hand. The tendon sheath became involved and, despite vigorous surgical measures on the part of a competent surgeon, the tendon itself became necrotic and sloughed away. When first seen by me about three months after the onset of the infection, there was still a superficial granulating wound on the base of the fourth finger. The finger was held acutely flexed and prevented the patient from using the hand. The possibility of a tendon transplant was suggested by the family physician at this time, but I had little hope of its feasibility, so extreme was the scar tissue formation. The finger was gradually stretched by means of celluloid splints each bent in such a way as to take advantage of the slight improvement gained by the preceding. Within two months the contracture had been entirely overcome and the range of passive motion much improved. No active motion was possible. All treatment was then suspended for a time and the patient allowed to use her hand as she wished, except that a little celluloid splint was applied at night to prevent the contracture from returning. Eight months after the original infection the scar tissue had loosened sufficiently to warrant an attempt at tendon transplantation. General anesthesia was used and an Esmarch bandage was applied just below the elbow. A lateral incision was first made over the distal interphalangeal joint, the flexor profundus tendon identified and threaded with the Bunnell stitch, using No. 1 chromicized catgut. A second incision was made at the base of the finger and the proximal stumps of the flexor sublimus and flexor profundus were found fused together and imbedded in scar tissue. They were left attached to one another but freed from the surrounding tissue and dissected upward for a distance of 1 inch. The free end was trimmed away until healthy tendon became visible. A channel was bored from the base of the finger to its tip running through the scar tissue in the line of the original sheath. Through this sheath a corresponding length of palmaris longus tendon, still covered with para-



Fig. 3. Photographs illustrating the range of active motion of the thumb 1½ years after the free transplantation of a portion of the flexor carpi radialis tendon to bridge a 2½-inch gap between the ends of the divided flexor longus pollicis tendon. The patient is a druggist's clerk and is able to perform the most delicate manipulations with the injured hand.

of the proximal phalanx to the middle of the distal phalanx. The surface of the bone was roughened and it was evident that if a tendon were transplanted it would, within a very short time, become adherent to the roughened bone. It was therefore decided to construct a sheath for the transplanted tendon. A strip of fascia from the right calf 2 inches long by 1½ inches wide was removed and implanted over the roughened bone with its gliding surface turned towards the skin. The tendon ends were left free,



tenon, was drawn and fastened to the injured tendons by means of the Bunnell stitch. Continuous skin sutures. The finger was immobilized in a flexed position. Active and passive motion were begun on the fourteenth day. At the present time, six weeks after the operation, there is almost the normal range of active motion at the metacarpophalangeal joint, 25° of motion at the proximal interphalangeal joint, but practically no motion at the distal. The lack of motion at the distal joint is probably due to the marked destruction of the joint itself, rather than to lack of function of the tendon. The patient uses the finger for almost all purposes and considers her hand almost normal.

These four cases, taken from a series of twelve, indicate different types of injury for which the free tendon transplantation may be used. They are characteristic of a group in which the tendon transplant is used for the purpose of reconstructing a tendon and thus utilizing the normal function of a muscle which would otherwise be quite useless. I am not dealing in this paper with the use of tendons as ligaments for the strengthening of weak joints or, as has been suggested by Gallie, for approximation of bone fragments after fracture of the patella or of the olecranon process. It is self evident, that, if a tendon will heal in and can be made to glide, the much simpler operation of implanting it, with the idea of fixing it to the surrounding tissues, will almost invariably succeed. The surgery of tendons is most decidedly in the process of growth and much still remains to be said about the best method of free transplantation. This paper is written not to dogmatize, but to indicate a line of procedure which appeals to me because it seems physiological and because it has given gratifying results in 75 per cent of the cases.

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## CLINICAL AND THERAPEUTICAL REMARKS ON CONTRACTURES FOLLOWING WAR WOUNDS.

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From the earliest months of the war, contractures following injuries of the limbs showed themselves in unexpected numbers. These have been divided into two groups: Some, not entirely resistant to passive traction, reducible under the influence of an Esmarch bandage, or anesthesia, are true contractures of psychic or reflex origin. The others, entirely irreducible, by whatever method, are pseudo-contractures, due to fibrous adhesions, musculo-tendinous retractions, muscular fibrosis, musculo-cutaneous adhesions, etc. In practice this division has not appeared so simple, but, in common with Dr. Roger, I believe that up to a certain point we can differentiate certain types, causes and methods of treatment.

Some contractures can be said to be functional and with no organic lesion left by the injury to account for them. They are psychological or even simulated. They do not always take on any particular form, but simulated contractions more often assume an imitation of "fixation" than of "creation", and contractures are often but a persistence, without any reason, of a recognized pathological symptom of organic origin, all wounds involving a muscle being associated with a certain degree of contracture.

However, if certain purely functional contractures can simulate perfectly contractures of organic origin, there are others that, by their aspect, reveal their etiologic diagnosis. We mean certain bizarre conditions, such as crossed fingers, etc., in which their very peculiarity is indicative of a neurosis (figure 1), and also a rather large group of contractures *in extension*. Leaving aside talipes equinus and equino-varus, we can say that nearly all contractures of organic origin are *in flexion*; functional contractures are often also in flexion, but when we see a contracture in extension, it is in all probability functional. In this group we have two common types, those of the leg and those of the hand.

Quite frequently the patients, wounded or not, come to us with the leg extended and stretched. It is one of the easiest attitudes to adopt and to hold;



all attempts at forcible flexion fail. The quadriceps muscle is powerful and resistant. In every case with or without a more or less slight wound of the anterior aspect of the thigh we have been able to convince ourselves on the field that we were dealing with a contracture, not only functional but even simulated, and we have reduced it at once by force and by treatment "moral" rather than truly psychotherapeutic. We have never observed, following peripheral wounds, contractures in extension of the leg of organic origin. If such a contracture exists, it certainly is very rare. A common functional va-

Among the organic contractures following war wounds we have classified three groups, without pretending that these are the only ones that deserve to be recognized.

1. In a great number of cases the projectile passed *at the level of, or in close proximity to, the contracted muscles*. These are the cases, for instance, with the biceps in the arm or the posterior muscles of the thigh in contractures, in flexion of the arm or leg (figure 4). These contractures are sometimes so pronounced that the segments of the limbs are at right angles to each other. These contractures are considered by some to be psychopathic or pseudo-contractures due to musculo-tendinous contractures, or to muscular fibrosis. Applying the Esmarch bandage at the beginning of the extremity will relax the contractures, but not the pseudo-contractures, and it determines the diagnosis in each case. In



Fig. 1. Neuropathic contraction of the hand. The peculiarity of the attitude shows immediately the functional origin. Cured in one sitting by suggestion.



Fig. 2. Contraction in flexion of the hand and fingers, following traumatism (explosion of shell).

riety is contracture in extension of the hand and finger. Several varieties manifest themselves. Sometimes the fingers are stretched and spread, either all the fingers or in groups of two or three. In these cases malingering seems to be a game. In other cases we find the hand stretched out but the fingers close to each other, sometimes overlapping in the classical attitude of the "obstetrical hand" (figure 3). This attitude, due to the contraction of the interossei, appears to be essentially functional, more often neuropathic than simulated. Babinski and Froment consider this "obstetrical hand" to be "reflex" or "physiopathic".



Fig. 3. Obstetrical hand, of functional origin.

reality the Esmarch bandage does not relax them entirely, but, as we shall presently show, this does not prove that we are dealing with a true contracture.

However, whatever the cause, the etiology has very often been revealed to us by the *x-ray* (figures 4, 5, 6, and 7). In a large number of cases we have found either fragments of metallic substances, more or less voluminous, or what was more frequent, a disseminated metallic dust. This dust, sometimes not revealed by the *x-ray*, is evidently the source of irritation, not so much on the motor nerves as in the muscle fibers themselves.

Certainly we are not dealing here with psychopathic contractures, and less still with retractions or fibrosis, for we have often been able to obtain, without much difficulty, a complete and immediate reduction.

In one case the irritative material consisted of small particles of bone, separated from the neighboring bone, on which could be seen a slight irregularity



at the point where the bullet came in contact, and the resulting periostitis. This slight lesion had escaped the observation of the roentgenologist.

Similar findings have occurred in a sufficient number of cases to show that this is not a coincidence. They are of interest as they indicate one way by which organic and functional contractures may start. They are also of interest in explaining certain cases in which the x-ray does not reveal anything. There is good reason to believe that non-metallic foreign bodies or non-osseous substances would escape discovery by the x-ray, but may cause similar contractures, either by irritation of nerve filaments or muscle fibers. It is also possible that



Fig. 4. Contraction of the forearm on the arm, after wound of biceps. This was due to small fragments in the biceps as shown by the roentgenogram.

small scars, even very small, can act as foreign bodies in the same way without, by their presence, interfering with motion.

In a certain number of cases, much less common, the irritation is of the nerve itself. The wound is at a distance, sometimes a considerable distance from the contracted muscle. There is further confirmation in the belief that it is a purely functional affair, in that one muscle alone, or a small number of muscles, supplied by the irritated nerve, are affected. We know today by physiological experiment and the electric experiments on man, by Pierre Marie and Meige, that the innervation of a muscle is individualized on a certain portion of the circumference of the nerve trunk from its origin. We can therefore conceive that the localized irritation of a nerve can produce

effects, at a distance, on certain groups of muscles, or individual muscles themselves.

Here is an example of a case of limited contracture due to nerve irritation at a distance: Patient, wounded December 21, 1914. The bullet entered between the middle of the spine and the left scapula. It was removed a few days afterwards, on the superior border of the sterno-cleido-mastoid muscle, two fingers' breadths above the left clavicle. The left arm stayed inert for ten days or so, then the pa-



Fig. 5. Contraction in flexion of the forearm on the arm. Small fragments in the muscle.

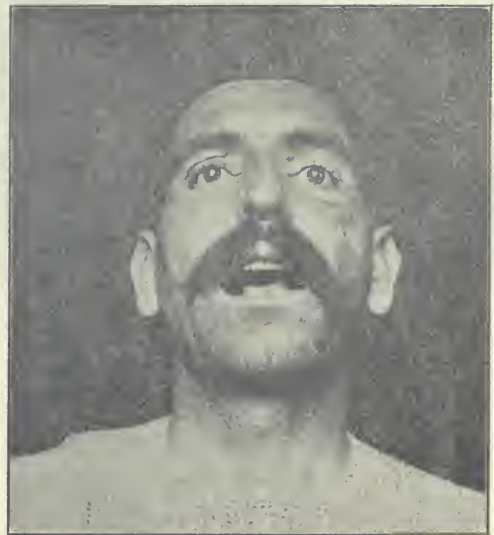


Fig. 6. Contraction of masseter after wound of left cheek. X-ray examination showed a trail of metallic fragments in the muscle.

tient began to be able to move it. When he came to the neurological center, certain movements were still incomplete—extension and flexion of the forearm, extension and flexion of the fingers, etc. At the present time, all motions are about normal, except one,—extension of the forearm. This extension is limited by the contracture of one muscle alone, the long supinator (figure 8). This contracture developed about three weeks after the wound. Since then it has persisted, making a ridge along the ex-



ternal border of the forearm, limiting the extension of the forearm to a right angle, going into a spasm at all attempts at passive extension, and being an insuperable obstacle to extension, more so even than could be found in a characteristic musculo-tendinous retraction.

Offhand, however, this isolated contraction of a muscle, distant from any wound, seemed to be entirely functional, but at the level of the extraction point of the bullet, that is, approximately at Erb's point, palpation reveals a hard mass, probably of bone, which appears to be more or less adherent to the vertebrae, and roentgenographically appears to be the callus of a fractured rib which has moved upwards. The contracture of the long supinator thus becomes explicable. It is quite evident that at Erb's point, pressing against one of the upper roots of the brachial plexus, there is a permanent cause of irritation.



Fig. 7. Contraction of paravertebral muscles following wound of the neck, absolute rigidity developing. X-ray examination showed minute metal fragments in the muscle to be the cause. Ultimately cured without operation.

Without a careful examination, this limited contracture, so far from the wound, would have been considered of purely psychopathic origin.

A third variety of contracture of organic origin should be well known. It is of those which occur in all, or some of the muscles antagonized to paralyzed ones. This does not necessarily mean retraction of these antagonistic muscles, as was believed. The possibility of reducing the contracture and the movements produced by electric current, demonstrate this.

At first there is only a difference in tonicity, then little by little the contracture develops, and the attitude of the limb becomes entirely different from that of simple paralysis. In most cases it occurs in the hand, almost always in a musculo-spiral paralysis; this is probably due to the fact that normally the

flexors of the hand are much stronger than the extensors. The fingers become flexed in the hand, particularly at the level of the first and second phalanges. The hand takes the attitude of a closed fist with the thumb on the outside. Because of the flexion of the fingers, which separates the points of insertion of the extensors, the wrist is lifted, sometimes even higher than the horizontal, particularly if the radial paralysis is not complete; this pulled up hand, this closed fist, often rigid (figure 9), does not at all give the appearance of the falling hand, extended fingers, of the classical musculo-spiral paralysis.

It can be conceived that the progressive new attitude tends to occur at the time when the radial paralysis begins to improve. This is what we have seen most often. It also is liable to occur if a per-



Fig. 8. Contraction limited to the supinator longus. This was due to the irritation of the brachial plexus by rib fracture, resulting from a bullet wound.

manent irritation, such as a musculo-cutaneous adhesion at the level of the wound of entrance or of exit, acts on the flexor muscles.

In certain cases of musculo-spiral paralysis, not all the flexors are involved in the contracture. Thus one may see the first phalange extend gradually as the musculo-spiral nerve recuperates, but the hand stays flexed, incapable of any extension. It is just the opposite of normal recovery from musculo-spiral paralysis. Passive extension of the wrist is quite as impossible as active extension. One has only to feel in the flexor surface of the forearm the cord made by the contracted muscles to appreciate the cause of the anomaly.

In the lower limb, similar conditions may occur; for instance talipes equinus, hard to reduce, will develop on a flaccid foot-drop due to paralysis of the



external popliteal. In this case again the predominating action of the antero-external muscles plays a part and it is nearly always at a late period that the contracture occurs.

In all these cases, without a careful examination, the anomaly of the attitude might be taken for a purely functional contracture.

What makes it essential to differentiate these various groups of contractures and pseudo-contractures is the fact that their *treatment* is essentially different.

As far as the purely *functional contractures* are concerned, we don't have to go into the various methods of psychotherapy and the faradic current which, in a short time, will clear up contractures in the "obstetrical hand" attitude. In military neurology we are, however, in the presence of a certain amount of resistance that we do not meet in civil life, even in compensation work, and it is due to the



Fig. 9. Contraction in flexion of the fingers with extension of the wrist in a late sequela of musculo-spiral paralysis.

small desire the patient has got to get well, even when he has not imagined his sickness. In these cases, isolation, in separate rooms, or if not practicable in booths, does wonders. It isolates the patient from the outside world where, as we know, charitable souls have a predilection for neuropathics and malingerers, not only the most interesting of the war, but often the torment of the doctors.

Among the various functional contractures, there is one that I wish to mention, because I have often seen it in malingering and in nearly every case it is purely simulated. This is: contracture, in extension, of the leg. These can be done away with, right away, in most cases by force and tenacity, using the leg as a lever and the foot of the bed or your own knee as the fulcrum. Once the contracture is overcome, the patient convinced, the knees remain easily flexible. Disciplinary measures are all that are neces-

sary to keep up the cure. I have yet to see such a contracture recur.

Of more interest is the treatment of contractures due to *organic causes*.

*For contractures close to a wound in the neighborhood of the contracted muscle*—in the majority of cases—contractures in flexion of the arm or leg we proceed thus: The roentgenograms having revealed to us, in a large number of cases, the presence of foreign bodies, we have the patient *x-rayed*. If a rather large foreign body is present, the best policy to follow is of course to remove it. In the majority of cases, however, there is more likely to be found metallic dust. Theoretically we should remove it, but nearly always this is impossible, and be-



Fig. 10. Patient of figure 4, wearing the apparatus for ambulatory treatment of flexion contracture of the forearm by graduated extension. The patient was thus cured.

sides we have cured many of these contractures medically, in spite of the presence of even fairly large foreign bodies. The first thing we do is to try to reduce the contracture at once; to do this, we attempt to extend the limb, by slow traction, very progressive and without any sudden jerks. If reduction is too painful, we make use of the Esmarch bandage, which generally decreases the rigidity; sometimes we give injections of cocaine, along the path of the missile and especially in the region of the tendon. When the patient consents to general anesthesia, which is exceptional, this is still better.

Very often while the attempt is made to extend the limb a tactile (and sometimes auditory) sensation is felt as if pressing on snow, which indicates the rupture of fine adhesions between the skin, aponeurosis and muscle, or even in the muscle itself.



It is worth noting that similar sensations are felt in really functional contractures far from any wound, which proves that a constant posture, even if neuropathic, can lead to the formation of adhesions after a certain length of time. The patient is really unable to stretch the flexed limb, and the Esmarch bandage is also unable to relax the limb. Therefore, as we have said previously, we do not consider that the Esmarch bandage test is very conclusive to differentiate true from false contractures.

Even when the Esmarch bandage has not accomplished any results, however, it is possible to obtain complete extension of the limb, and this may be permanent. When the limb is entirely extended it is immobilized in a splint for three or four days. When the splint is removed, it is not rare that the extension remains permanent, even when the contracture is manifestly caused by small foreign bodies and the reduction was accompanied by characteristic crepitations due to adhesions.

In a great number of cases immediate reduction fails, even with anesthesia or, if obtained, it lasts only as long as the splints are kept in place. In these cases we are not inclined to paralyze temporarily the nerve by injections of alcohol, as suggested by Sicard. Without considerable experience we fear to paralyze it permanently. I believe it more advisable to proceed by slower and progressive methods, by gradually extending the muscle and getting it used to the irritation of the foreign bodies; in other words, to practice a real muscular re-education.

In this respect, mechano-therapeutics methodically applied and repeated every day, or several times daily, always done without undue pulling or any sudden movements, give nearly always very good results. We are surprised to see that several writers consider this detrimental. The apparatus of Privat, consisting of a rope, a pulley and a weight, is particularly useful. In one or two months we have obtained extension, nearly complete, of a forearm or leg, which previously was irreducible and seemed to be justified by the presence of foreign bodies. But in this treatment a certain factor plays a tremendous part; that is, the good will and to a certain extent the intelligence of the patient. It was among the officers and non-commissioned officers that we obtained the best results.

If daily traction, for a certain length of time, is so encouraging, certainly continuous traction should be very beneficial. We have applied it with fair success in cases where keeping in bed and relative isolation have had an effect in restoring co-operation

as well as on the muscular contraction itself. In other cases we have deemed it advisable to apply continuous extension, without necessarily keeping the patient bedridden. It is for these cases that we had made various apparatus, cheap and rather simple, which allowed real continuous extension while still allowing the patient to walk about (figure 10).

These consist of two splints made of tin, which are laced in place, one to the arm, or to the thigh, the other to the forearm, or to the leg on the side of flexion. The two splints are united by two lateral hinges, similar to those of medieval armors. They are also united on their free surface by a screw which engages a toothed wheel. After putting the apparatus in position, so that the limbs are extended as much as possible, every day or every second or third day, the wheel is turned one notch, thereby stretching the limb further. So placed, the apparatus not only allows one to graduate the continued extension but enables one to judge the progress. This can be put down in figures, by measuring the distance between the furthest points of the two splints.

We have not as yet sufficient experience in these apparatus to judge of their value, but we do not doubt that they will give good results, at least as good as extension of the limb in bed.

We consider that tenotomy should be resorted to only as a last measure in rare cases. As for the treatment of *contractures due to irritation of nerve trunks*, we have very little to suggest. The only logical treatment is the removal of the irritation whenever possible; thus we are going to have the bony mass removed in the case of irritation of the brachial plexus, causing the contracture of the long supinator.

For *contracture of muscles antagonistic to the paralyzed ones*, a remark is necessary. It occurs nearly always, when the treatment has not sufficiently isolated the paralyzed from the non-paralyzed muscles. For instance, in musculo-spiral paralysis if all the muscles of the forearm are massaged, instead of massaging only the extensors; or again in using the faradic current, the affected muscles are not stimulated, because they are not susceptible to stimulation, while the healthy antagonistic muscles are; or again by the use of the application, in baths, of galvanic current (a method necessitated by its convenience in a heavy war service) the sick muscles are stimulated, but so are also the healthy muscles which already had a marked preponderance.

These remarks justify these rules in treating peri-



pheral nerve paralysis: never massage non-paralyzed muscles; never employ faradic current; use only galvanic baths as a last resort, and, in every case, if contracture does occur, apply only galvanization with plates and so feebly that there will not be diffusion of the stimulation to the non-paralyzed muscles. We may also add that contracture is most liable to occur in non-paralyzed muscles when the limb is left to itself without any mechanical support. Therefore, the various mechanisms that lift up the hand or the foot, in musculo-spiral or sciatic paralysis, particularly those with elastic traction (rubber, or better still, metallic springs) appear to us as important preventive measures against late contractures.

The few types of cases here discussed are not the only ones to be found following wounds of the extremities; they show that if, with little experience, we can sometimes diagnose at once certain purely functional contractures, in the majority of cases we must make a diagnosis of purely functional, or psychopathic, or hystero-traumatic origin with a great deal of reserve, the *x*-rays often showing a point of irritation of organic origin. These cases must also show, leaving aside the problematic action of certain drugs, that the treatment must vary according to the cause of the contracture. This I believe justifies a careful study of each particular case.

#### REPAIR OF LOSS OF BONY SUBSTANCE AND RECONSTRUCTION OF BONES BY OSTEO-PERIOSTEAL GRAFTS TAKEN FROM THE TIBIA. (WITH 118 NEW PERSONAL CASES). GENERAL HENRI DELAGENIÈRE. Chief Surgeon, French Army.

The idea of repair of losses of bony substances by periosteal bone grafts is old and is due to Ollier. He reported a case of transplantation of a piece of tibial periosteum under the skin of the forehead, to remodel a nose. The operation was performed May 13, 1835. The periosteum was removed from the bone, the skin of the forehead elevated and the graft introduced underneath. There was suppuration and because of the fear of possible erysipelas, the piece of periosteum was removed. When this was done it was found to be adherent at several points, and therefore was beginning to grow.

Ollier did not attempt this again and from then on tried to remake noses by means of strips of periosteum adhering to mucous membrane or bone, without trying to establish a general method for bone

reproduction. In other words, he conceived a method, but was stopped by the danger of infection which could not be avoided in those days. Instead of an osteo-periosteal graft, he attempted a simple periosteal graft, and tried to reconstruct the skeleton of the nose, without attempting to reconstruct a portion of a bone.

This case was nevertheless the first of its kind and has been the start of all the attempts that I have made to reconstruct bone. I am therefore very pleased to be able to honor here an old master, who was good enough to favor me with his friendship, honor due to a discovery which, when modified by modern medicine, has afforded relief and cure to a large number of wounded people.

The failure of bone-grafting as done by Ollier, seemed to be the result of two factors. First, by removing a strip of periosteum with a chisel a certain number of osteogenic cells were left on the bone; secondly, the transplanted piece of periosteum was not under normal physiological conditions and its osteogenetic properties were interfered with. For this reason I take with the periosteum a strip of bony tissue in which all the osteogenetic cells will be found. Furthermore, this strip of bone, by its presence helps to keep this periosteum spread out and make it more easily adapted to the various places it must grow upon.

I therefore take, on the internal surface of the tibia, an osteo-periosteal graft, that is the periosteum, attached to a layer of bone, and transplant it to the place it is to be grafted upon. But remembering the elimination of the graft of Ollier, I perform the first graft in two stages.

CASE I. A female of 14, who had the nose completely destroyed by lupus and had several operations to remove the damaged tissue.

November 29, 1905, by means of the chisel and mallet I removed an osteo-periosteal graft on the internal surface of the tibia (left). This graft measured 9 cm. in length and 2 cm. in width. It was left adherent to the bone towards the upper end of the tibia. The skin over the tibia was sutured in such a way as to allow the graft to protrude. A tunnel was then prepared on the anterior surface of the left forearm and the graft introduced in it. The forearm was kept in position by means of a plaster cast.

December 13, 1905, the pedicle of the graft was cut and the small wounds of the tibia and forearm sewed up.

The graft took on considerable growth. An Italian graft was made on the 26th of March, 1906, with the skin of the forearm containing in it the osteo-periosteal graft. The first stage was performed on the 26th of March, the second on the 5th of



April, 1906. When the graft was separated it was bent and planted in the lip until the bony contact was established.

On November 21, 1906, the patient came back because the nostrils had become obstructed. The graft had taken and was very solid. Two openings were made in the skin that closes the nostrils, and an epidermal skin graft, curled around a small drain, were introduced into the openings.

The patient returned December 10, 1906. She was doing well and breathing through the nose which unfortunately had proliferated and was too large.

This case therefore gave a complete result as far as the graft was concerned, but the difficulties in performing the graft in two stages, decided me to attempt direct transplantation, as in the two succeeding cases.

CASE II. A female, 21 years old, had her nose completely destroyed by a lupus which had been treated by Finsen rays in Paris.

February 6, 1907, cleansing of the nose and excirpation of all the mucous membrane; then an osteo-periosteal graft 7 cm. long and 15 mm. wide, was introduced in a subcutaneous tunnel, made in the left forearm, to furnish a skeleton for the nose.

March 13th, first stage of an Italian graft with the skin of the forearm containing the graft.

March 22nd, second stage; the graft separated from the forearm with skin, then bent and fixed at the base.

The immediate result was fairly good as far as the graft was concerned, which took well, and was solid, but the reconstructed nose was irregular in appearance.

This patient was seen again October, 1917. The nose was hard and solid, the graft held well but the nose was deformed. No recurrence of the lupus.

CASE III. Man, 30 years old, presented a pseudo-arthritis of the left radius, resulting from an old fracture of the middle third.

March 31, 1906, opening of the arm, freshening of the bony extremities, to a length of 2 cm., introduction of a sterile nail in the medullary canal so as to keep them more or less in contact, then an osteo-periosteal graft taken from the tibia, 8 cm. long and 20 mm. wide.

This graft was then applied around the bony extremities, the proliferating surface on the bone. The tissues were sutured on top of the graft and the skin brought in apposition. Perfect cure.

The patient came back June 11, 1907, with a solid radius and able to pronate and supinate.

These three observations show that an osteo-periosteal graft can be transplanted in any tissue to live and take up its osteogenetic functions.

From this period on I have had recourse to osteo-periosteal grafts in all cases of pseudo-arthritis in which I have had to operate.

The bone injuries in the war wounded have offered me many occasions to apply these grafts.

Loss of skull substance in trepanation, loss of bone in the face, loss of mandible, pseudo-arthritis with, or without, loss of part of the long bones, flail joints, resulting from too extensive resection of the knee, etc., can be cured by this method. Furthermore, it can be applied to a good many other conditions as can be seen in the subsequent report.

The graft must have the thickness of a ten-cent piece; it must never consist of the total thickness of the internal surface of the tibia.

It consists of a periosteal-bone graft lined throughout its whole length by a thin layer of bone, whence the name, *osteo-periosteal graft*.

The bony layer is essential to give consistency to the graft, to keep the periosteum stretched, to keep it in its physiological condition, so that its osteogenetic functions can continue normally.

To obtain the graft all that is necessary is a chisel and a mallet. The internal surface of the tibia is exposed by a longitudinal incision, care being taken not to injure the periosteum. On this internal surface, by means of a scalpel, the outlines of the grafts are made out, one under the other. In this way, one, two or three grafts of five, six, twelve centimeters length are outlined, thus utilizing all the inner surface of the bone, if need be.

When all the grafts are thus outlined, the chisel follows these lines, penetrating well into the bone. It is then inclined obliquely, nearly parallel to the internal surface of the tibia and the osteo-periosteal layer is removed, exactly as a carpenter removes a wooden chip. The chisel must not be inclined too much, for fear of leaving a portion of periosteum without any bony lining, neither must the chisel be held too much in the perpendicular, in which case the medullary canal might be penetrated and the graft be too thick, besides causing an unnecessary lesion of the tibia.

When the grafts are separated, they take the appearance of thick chips of wood. They are rolled up on their periosteal surfaces and are elastic enough to be pleated, bent, curved or modelled according to the position in which it is desired to place them. They are then placed in the wound where a bed has been prepared for them, and are carried thereto on a sterile compress.

To obtain good results it is necessary to observe the following rules, which apply to all osteo-periosteal grafts:

It is absolutely necessary that the graft be in contact with living tissue. On the skull this condition is easily obtained, the two surfaces of the graft are



in contact with layers of tissue, very vascular and without any spaces between, and this is the reason why in plastic work of the skull results are the most rapid and most constant.

By living tissue, we mean tissues as near normal as possible and preserving all their vitality. We must therefore remove with care all sclerosed tissue so that the graft will be in as physiological a condition as possible. In certain cases it is necessary to leave cicatricial tissue in order to avoid opening infected cavities; in these cases the graft may take, but the result will be much slower and less perfect.

Antiseptics must be omitted entirely, but of course absolute asepsis is essential.

Finally, there must be no dead spaces where blood might accumulate and form hematomata which might secondarily become infected. This question of hematomata is very important, for it is to this condition that most of our failures are due. Hemostasis must be as complete as possible. Then the grafts are covered over with a thick layer of tissue well sutured over the graft with catgut stitches. In this way all dead spaces are avoided as well as blood effusions.

This has also the advantage of holding the graft in place, which is absolutely essential, until the various apparatus are applied to immobilize the part until the complete consolidation of the graft.

These principles being outlined, I shall now describe the operation itself.

The operation consists, for each variety of bone graft, of the preparation of the bed for the graft, the operation on the extremity, the placing of the graft in its position, the closure of the wound, the keeping together of the bony surface during the growth of the graft and the formation of new bone.

I. CRANIOPLASTIES. The wound must have been completely healed and the integuments sufficient to cover the graft and the operative field after removal of all subcutaneous cicatricial tissue. It is necessary to make use of the scar, whatever its condition be, and to open the field of operation just as one would for a simple cutaneous autoplasty. One therefore makes a longitudinal incision, stellate incisions, or a trap-door flap, as may be indicated. Each cut through the cicatrix is made by two incisions converging in the depth, so that each margin is feather-edged and can be more easily sutured without rolling up. The incision having been made, the skin flaps are raised, chiefly by peeling back, far enough to provide that the wound can be easily closed without tension. The two, three or four flaps are then covered with com-

presses and turned aside. There now remains in the center of the wound a star-shaped or linear cicatrix which one dissects with care from the deeper tissues and removes completely.

When the field of operation is thus exposed, the opening to be closed by the bone graft is explored with the finger. In most cases it consists of the opening of a trepanation, either round, or oval, and occasionally irregular. The pericranium around the opening is incised down to the bone with a scalpel and is pushed back 2 or 3 cm. all around the opening. It is in this space that the bone grafts are placed and it is this raised periosteum which will hold them in place. All bleeding is controlled. The wound is covered with gauze tampons while the graft is being cut from its source, as above described.

*Placing the bone grafts in position* is very simple. They must be placed one next to the other, like a parquet flooring. To obtain solid ossification in a short time, it is necessary that the bone grafts should be in contact with each other, or better still, slightly overlapping. Unless there is some contraindication, the proliferating bone surface must be placed on the exposed tissues and therefore on the brain, the periosteal surface in contact with the pericranium. This has the following advantages: The osteo-periosteal graft takes contact with the bone by its proliferating surface, and becomes solidly fixed, furthermore the graft presents its periosteal surface to the overlying tissues and does not adhere to it and the scalp is then easily movable over the bone graft.

At first I used to place the proliferating side of the graft externally because of the fear of the bone graft beginning to proliferate and cause pressure on the brain and irritation of the meninges. But such proliferation of the bone graft is not a thing that happens very often and it seems fairly easy to be able to avoid any such accident.

The only cases in which I found it necessary to place the grafts on the wrong side, so as to prevent any possible irritation on the brain from the bone graft are:

1. When there is a hernia cerebri.
2. When there are symptoms of Jacksonian epilepsy, in which the cause is not found during operation to be due to a piece of bone, or a thick scar adhering to the brain, or in which the cause cannot be removed.
3. In subjects below 20 years of age, who have been found to have proliferation of the bone graft more frequently than others.

The skin flaps have been previously prepared so



as to unite very closely. All that is necessary, therefore, is to bring them together, care being taken not to move the bone grafts which are kept in place only by their covering of pericranium.

Drainage is not absolutely necessary, it can be omitted if the dressings are changed every day for the first four or five days following the operation. When this is impossible, it is best to drain and put on a dressing which may be kept in place for four or five days after the operation. After this the drain can be removed and a second dressing applied which may be kept on to the ninth or tenth day after the operation, at which time the sutures can be removed. The wound after this need be protected only by a slight dressing.

*Position in which to place the patient.* If the bone defect was considerable and the wound is old, and when there is loss of cerebral tissue, there exists prior to the operation a considerable depression which must be done away with. In these patients, the depression is increased in the vertical position. In the horizontal position, this depression decreases and occasionally disappears. It is therefore logical to place the patient, after operation, in the horizontal position, even with the head slightly lower than the rest of the body and to keep him in this position until the bone graft has become solid. This procedure has given me excellent results, especially if, while applying the bone grafts, care is taken to model them to the shape of the skull.

After a fortnight the grafts appear solid, but it is best to keep the patient recumbent with the head low for another two weeks.

II. PSEUDO-ARTHROSIS OF THE MANDIBLE WITH LOSS OF BONE. This condition necessitated considerable investigation, but I now consider the problem solved. By means of osteo-periosteal bone grafts, it is possible to cure any pseudo-arthritis of the lower maxillary and fill up any loss of bone. But in this condition it is also necessary to have recourse to specialists. After operation, it is necessary that the bone grafts be kept in position by means of splints inside the mouth, which are to be kept there until complete consolidation. The apparatus is placed in position during operation, but as soon as the patient wakes up and stops vomiting, the jaws are immobilized by wiring the splints.

This apparatus is sufficient to keep the maxillary bones in good position and the periosteal proliferation is sufficient to fill up the loss of substance and form a bony mass which will allow the patient to chew and to wear false teeth, if necessary.

It is therefore absolutely unnecessary to have recourse to metallic plates or metallic sutures as I used to do. All these pieces of metal are foreign bodies and must eventually be removed in the majority of cases. They are more of a hindrance than a help to a bone graft and I have stopped using them.

*Exposure of the bony extremities and preparation of the grooves for the bone graft.* Previous to the operation, the mouth of the patient must be in good condition. I use, if possible, the existing scar to expose the bony extremities. The scar is the result either of the original wound or of a primary attempt at a plastic skin operation. In these cases more so even than others, it is necessary to cover the wound with a layer of viable and freely movable integument. As in cranioplasty the scar is circumscribed by two converging incisions, cutting the skin obliquely, so that the flaps can be sutured without rolling up the skin. The flaps are dissected up far enough to allow them to be brought together on top of the grafts without any undue stretching.

To keep the ascending ramus of the mandible in position caused me considerable worry at first, and this is the reason that I used to employ metallic plates, screwed tightly in the two pieces of bone, but experience has shown me that this is of little importance, even when the end of the bone projects in the mouth. All that is necessary is that the bone graft comes in contact with an exposed end of bone to make a solid mass. When this bony mass is well established articulation of the mandible re-establishes itself, whatever the position of the condyle.

When the wound is exposed, the position of the two bony ends is determined as well as their relation to the mucous membrane. It is absolutely necessary to avoid opening the mucous membrane for fear of infection of the bone-graft.

The finger of the assistant is introduced into the buccal cavity and is made to follow the deviations of the ends of the bones. In this way tearing of the mucous membrane is avoided, which is essential in order to avoid the introduction of bacteria in the field of operation. Once the positions of the ends of the bone are known, an incision is made in the soft tissues, between them. The ends of bone are liberated for an extent of about 2 cm., if possible, so as to allow of placing one graft behind or below, and a second on top of each end. Following then the previous incision, an attempt is made to cut out two flaps 1.5 cm. each, so as to introduce, in their place, the graft which will bring together the two extremities of bone.



All bleeding points are then controlled, so as to avoid any possible hematoma. Then the wound is tamponned while the graft is being made.

Two grafts are all that are necessary for a simple loss of bone of the horizontal ramus, whatever may be the length of the gap. Three or four bone grafts are necessary, if it is desired to reconstruct the angle of the inferior maxillary, that is two for the horizontal and two for the vertical ramus. These four grafts are interposed, perpendicularly, to make the angle, and so as not to displace them it is well to transfix them with a double catgut ligature on each side of the bone graft.

Each bony end must be placed between two bone grafts, each graft must have its cut surface on the bone so that the two bone grafts adhere to each other by their inner surface. If four bone grafts are used to remake the angle of the jaw, the two vertical pieces are placed with their inner surface on the superior extremity of the ascending ramus, then the two horizontal pieces on the anterior extremity, the inner surface always contacting with the jaw bone. At the angle the pieces are placed without paying much attention to the inner surface and then are transfixed with a double strand of catgut. The grafts are covered by flaps of soft parts sutured over them. Finally the skin is brought together and sutured with interrupted horse-hair stitches, attempting to obtain as regular a scar as possible.

As in the case of the skull, drainage is not necessary, if the wound can be watched. As a protective dressing gauze with a little cotton is all that is necessary. This dressing is changed every time it is soiled and the stitches are examined carefully to avoid any possible stitch abscess, removing any suspicious stitch that appears to be causing irritation, evacuating any stitch-hole secretion and, if necessary, inserting a skin clip to replace the suture.

Post-operative care is very simple; the patient is placed in bed and allowed to react from the operation as any other patient. When he appears to have finished vomiting and to have recovered from the narcosis the two parts of the dental splinting apparatus are brought together with silver wire. The apparatus brings the two jaws into proper occlusion and it is in this position that consolidation takes place.

The apparatus is kept in place for 30 months. Union takes place earlier but under no condition must the mandible be set free without being sure that there is complete consolidation. In certain cases it takes a very long time before the bone becomes

solid enough. In some of our patients it took more than a year.

In our first patients, we believed that our results had not been satisfactory when as a matter of fact there was only delay in the process. This was particularly noticeable when there was a slight infection of the wound. This shows that slight infection does not interfere absolutely with the growth of the bone graft; it of course is detrimental, but unless the bone graft has been completely destroyed it will finally proliferate and give the result desired.

This observation is important, for we must not consider a delay to be an absolute failure.

With this technic, bone grafts of the mandible give satisfactory results and failures are rare.

III. PSEUDO-ARTHROSIS WITH LOSS OF SUBSTANCE IN LONG BONES. The technic is the same whether we are dealing with a simple pseudo-arthritis or one with loss of substance.

The procedure is as for the maxilla. The skin must be dissected as in a plastic operation, for it is necessary that the wound be covered with flaps that are viable, movable and free from tension on the sutures.

The bony ends are denuded and freshened. The bed for the bone graft is made carefully and enough soft tissue is left so that it can be closed above the grafts. It is necessary that the grafts extend at least 2 cm. on the ends of bone and these ends must be placed between two bone grafts, with their proliferating surface on the bone.

An extra graft can also be put in between these two, but this has very little advantage. I am satisfied to use two bone grafts even to reconstruct a considerable loss in a thick bone, such as the tibia.

If we are dealing with a simple pseudo-arthritis without any loss of substance, I simply wrap one graft like a ferrule around the bone ends, well denuded and freshened, and I keep this bone graft in place by means of a piece of catgut. But in this case I am careful to cushion the soft tissues around the graft to keep it snug against the bone.

When the two grafts have been placed in the beds prepared for them, they are covered over with the flaps made of the soft tissues, sutured with catgut. The skin is sutured with horse-hair.

To keep the bones in good position I use a plaster cast, applied with the limb in the best position for union. For instance, for the bones of the forearm, the limb must be supinated and the elbow must be included in the apparatus. For the arm, the limb must be abducted and the plaster must include the



thorax. For the leg, the foot is slightly abducted and the knee must be included in the plaster. For the thigh, the limb must be placed in abduction and the apparatus come up as high as the thorax.

The plaster casts are changed every month so as to correct as best as possible any deformity which the leg may have taken. These must not be entirely corrected until complete ossification. Ossification will take much longer in cases in which large quantities of bone substance have been lost. Sometimes it takes as much as eight to ten months to get good union and a strong bone.

IV. CLOSURE OF BONY CAVITIES. If we are dealing with bone cavities sterile and healed as we often meet with in the upper or lower epiphyses of the tibia, or in the condyle of the femur, the task is sometimes rather difficult because of the fragility of the bone which is often reduced to a shell. Cavities are also sometimes found in the diaphysis of the long bones.

All these cavities are fairly easy to close by filling with osteo-periosteal fragments. The technic is very simple. The skin is prepared as for an ordinary plastic operation, for the grafts must be well covered. The cavity is carefully curetted, then it is filled up with osteo-periosteal bone grafts, so that there are four or five layers of them. It is not necessary, if the cavity is very large, to fill it up to the brim, for this would necessitate a large quantity of bone grafts. It is more important not to leave any dead spaces between the bone grafts and in order to avoid this the dressings must exert a certain degree of pressure.

Good results can also be obtained in infected cavities in which healing has not occurred. The cavity is curetted, disinfected with hot air, and filled up with osteo-periosteal bone grafts which are covered over with healthy flaps. Healing will be progressive, fistulae will form with elimination of pieces of bone but the final result will be good.

V. BONES OF THE FACE AND OTHER GRAFTS. All the bones of the face can be reconstructed by means of osteo-periosteal bone grafts. All that is necessary is to attach the graft to the region to be made over. Afterwards it can be bent, rolled up, or folded to obtain the desired shape. The bone graft must get a start on a denuded bone. Superficially it appears to be very easy, the tissues are alive, dead spaces are easy to avoid and hemorrhages easy to control. Failures are rare and nearly always due to the opening of a sinus of the skull. The skeleton of the nose

can be made over entirely with bone grafts, either directly or indirectly.

Indications for bone grafting are numerous and will increase daily as the operative measures become more familiar.

The evolution of bone grafts is easy to follow with the x-ray. They can be seen becoming thicker and therefore more opaque. It can also be seen that the bone grafts proliferate bone tissue which unites with the osseous host and becomes the starting point for a new bone.

The bone grafts may become too exuberant in young adults. It is not a rare occurrence but is important only in work on the nose. This excessive proliferation was the reason that I used to place the proliferating surface externally in cranioplasty, for fear of irritating the brain, but I realized that this fear was exaggerated, and I now place the proliferating surface towards the brain.

As to absorption of the graft I never have seen it. If there was elimination of the bone graft, the results would certainly not be as good, but would not be absolutely unsatisfactory. The bone produced will be less solid and thinner, but it will be there nevertheless if the elimination has only affected the bone itself, leaving the periosteal layer. This will continue its osteogenetic function and will finally produce enough bone to obtain the necessary result.

The wound in the leg is insignificant. It will close by first intention, but it is best to drain it to avoid hematomata. I have never seen any severe complications from it. Occasionally small abscesses are formed, due to elimination of small fragments of bone. As a rule the wound heals up within a week.

My series of 118 cases\* gave me the following results:

Fifty-two cranioplasties with 44 very good results, 7 good results and 1 unsatisfactory result from elimination of the bone graft. In this case the operation was repeated and good results were obtained.

Twenty-seven grafts for pseudo-arthritis of the mandible, with loss of bone tissue, gave 10 very good results, 7 good results (not yet entirely cured), 2 satisfactory results, 3 partial results, and 5 bad results.

Twenty-one bone grafts for pseudo-arthritis, with loss of bony substance in long bones gave 15 good results, 3 partial results, in which 1 has a second pseudo-arthritis necessitating a second operation; 1 gave no results because of complete elimina-

\*Since this paper was written the number of osteo-periosteal bone grafts that I have performed is now 272 with good results in nearly all the cases.



tion of the bone graft, I died from septicemia (epileptic who would not do what he was told) three months after operation.

Three bone cavities with 3 successes.

Sixteen bone grafts for reconstruction of the face with 14 good results and 2 incomplete results.

One bone graft for cure of hernia, result so far unknown.

## THE OPERATIVE CORRECTION OF LONG-STANDING ERB'S PALSY.

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This paper is presented with the idea of bringing before the medical profession the facts that Erb's palsy or "obstetrical paralysis" can and should be treated so as to minimize subsequent deformity and disability. In the majority of cases the patient or parents are told that nothing can be done. This is not true and either the teaching of the medical schools is at fault, or the student's memory is poor.

What, then, is obstetrical paralysis? It is a paralysis of the arm, either partial or complete, usually due to a forcible labor, a big baby, a small pelvis, anesthesia, forceps, and generally a head delivery with the shoulder caught behind the pubes. With the above combination, force applied wrongly so as to separate the head and shoulder will often result in an injury to the brachial plexus.

The most common injury to the plexus is a tearing of the suprascapular nerve, as well as a tearing or fraying out of the fifth and sixth cervical segments where they come together, which junction is known as Erb's point. This results in a paralysis of the outward rotators of the arm, as well as the deltoid and triceps and supinator longus. In time, many of these muscles regain most of their strength, except the outward rotators, such as the supra- and infraspinatus and teres minor. Meanwhile, the internal rotators, such as the teres major, the subscapularis and the pectoralis major, which is also an adductor, become contracted because unopposed by normal muscles, and the condition of the arm then is as described below. Certain cases, if taken early, and placed on a splint in the abducted, elevated, outwardly rotated position, gain rapidly through massage and exercises. Others, even with good treatment do not do well and develop contractures. In fact, all cases develop contractures because of interrupted treatment.

Certain cases, more particularly the older ones,

say from five years up, develop a varying amount of posterior subluxation of the head of the humerus, due to the persistent, unopposed pull of the contracted subscapularis and teres major. This subluxation may be accompanied by a certain amount of acromial deformity, consisting in a bending down and forward of the end of the acromion, which is unopposed by the head of the humerus in its normal position. This acromial hooking may be severe enough to interfere with the proper reduction of the head of the humerus in the glenoid cavity, and an osteotomy has to be done upon it to lift it out of the way.

All cases eventually have more or less inability to fully and freely supinate, and a small number develop later a subluxation of the head of the radius which may lead to its resection.

The patient generally presents an arm with the following conditions: There is inability to elevate and abduct the arm at the shoulder,—rarely can the arm be raised to or above the shoulder level when abducted. There is definite passive and active limitation to abduction and outward rotation. There is active limitation to supination, which often can be fully performed with the elbow flexed and the arm at the side, but almost never can be done with the arm held in as abducted a position as possible, on account of the persistent inward rotation.

There is also inability to put the hand on top of the head or behind it. Often the only way a child can get the hand to the mouth is to elevate the elbow above the shoulder level; it has to be done this way because of the impossibility of outwardly rotating the arm. If one can not outwardly rotate the humerus, it is impossible to get the hand to the mouth without elevating the elbow, because of the persistent inward rotation.

Two types of paralysis are seen: first, the upper-arm type, which results from a lesion of the suprascapular nerve and the 5th and 6th cervical nerves at or about Erb's point. This injury produces a paralysis only of the muscles of the upper arm, with the exception of the supinators. The less usual, second, type, the so-called whole-arm type is the result of any injury not only to the 5th and 6th cervical nerve roots, but the 7th and 8th and possibly the 1st thoracic as well. Here the whole arm is flaccid, there is wrist-drop and paralysis of the small muscles of the hand. Eventually the shoulder muscles partially recover, but the lower arm muscles in the whole-arm type of case practically never do, and the patient is left with a badly crippled arm and hand.



## TREATMENT.

These cases at once resolve themselves into two divisions, namely, those to be treated with massage and exercises, principally those of the upper arm type; and those to be treated by operation on the plexus, usually those of the lower arm type. Unless the early treatment has been adequate, the upper-arm type will also come to operation, not for plexus repair, but to correct contraction deformities. This operation, which I have devised, will be spoken of later.

At first, in order to prevent contraction of unparalyzed muscles, it seems best to put the arm at rest in such a position that the muscles cannot become contracted. This may be done by holding the arm in a plaster cast, or by the use of a light wire or aluminum splint, in an abducted, elevated and outwardly rotated position, with the hand supinated.



Fig. 1. Before operation. Note inability to supinate and outwardly rotate.

This position can be maintained between massage and gymnastic treatments, and insures a better subsequent position of the arm. It also takes the drag off the paralyzed muscles, allowing them to regain their strength more quickly, and prevents subsequent shoulder joint deformity, such as subluxation and acromial hooking and overgrowth.

Massage and exercise are of the greatest importance and should be performed daily, if possible. It is most unwise to allow a child to become obsessed with the fact that it has an arm which cannot be used. Exercises that have been described by Dr. J. J. Thomas are most satisfactory, and have been developed during the past twenty years in the neurologic department of the Children's Hospital, Boston. The treatment should be continued for several years at least, and if contractures develop in the subscapularis and pectoralis major, they must be divided before any further range of action in the arm is to be hoped for.

In regard to the operation on the plexus in the usual upper-arm type of case, it might be said that in the experience of the author it has not been found necessary. In the lower-arm type of cases, the situation is quite different, but it cannot be too strongly

emphasized that no operation on the plexus will be of any great use in restoring functional activity to the arm, unless contracted and restricting muscles are divided, and careful after-treatment persisted in for a long period.

In regard to the operative treatment on the plexus in the lower-arm type of case, it may be stated that it has been done a number of times without any benefit. The plexus in all cases was found to be so badly torn and so bound down and invaded by scar tissue that any kind of repair was impossible.

The following operation was devised, following suggestions made by Fairbank. It differs from Fair-



Fig. 2. After operation. Note ability to outwardly rotate, abduct and supinate.

bank's operation principally in that the shoulder joint is not opened. Opening this joint leads to adhesions of the capsule, which are troublesome and fatal to the best functional results. In addition, I have found that complete division of the pectoralis major is always advisable, in that it is practically always tightly contracted, and so holds the arm adducted and prevents abduction and outward rotation. The subcapularis tendon can usually be easily found with the arm abducted and outwardly rotated after the division of the pectoralis major, and can be divided without opening the joint capsule.

*Operation:* An incision is made on the anterior aspect of the arm, beginning at the tip of the acromion and carried down to below the insertion of the pectoralis major. The cephalic vein is found generally in the outer edge of the wound and tied or drawn aside. The tendinous insertion of the pec-



toralis major is defined, raised on an instrument, and divided all the way across the bicipital groove. The pectoralis major muscle is then retracted inward out of the way, giving one a clear view of the axilla and shoulder joint. The arm should now be abducted fully and rotated outward as far as possible.

Following the division of the pectoral, the range of motion in abduction will be found to be greatly increased. Outward rotation will, however, be somewhat limited. With the arm fully abducted and outwardly rotated, the insertion of the tendon of the subscapularis is to be defined. This tendon is inserted on the lesser tuberosity of the humerus at its inner aspect, and its fibers run at right angles to those of the joint capsule, into which they merge. Just below and running parallel to the lower edge of the tendon may usually be found two or three small veins. The tendon of the coracobrachialis obscures

head of the humerus which cannot be fully reduced, an osteotomy of the acromion should be done, and the loose distal piece either removed or tilted up so as to allow the head of the humerus to slip back into the glenoid. The wound is then closed with a few deep stitches and a continuous catgut stitch for the skin. No drainage is required. Usually very little bleeding takes place. The arm is then placed on a wire splint, which holds it elevated to or above the shoulder level, abducted and fully rotated outwardly with the hand in full supination. At the end of ten days, massage, baking and exercises are begun, and are continued daily, or at least four times a week. The splint should be worn at night for at least three months and daytimes for at least three months longer.



Fig. 3. Mary W. Before operation. Right arm.

the insertion of the subscapularis tendon at times. It is then necessary to separate the origin of the coracobrachialis from the coracoid process by means of an osteotomy, which gives one a much clearer field to see the insertion of the subscapularis. The hole in which the surgeon is working is quite a deep one, and the tendon cannot be easily found unless the arm is in the position above described. The best way to divide the tendon is to pass under it some blunt instrument and so define it. It is of the utmost importance that the shoulder joint should not be opened. The tendon of the subscapularis should always be found, identified and lifted up before it is divided. Blind cuts along the capsule do more harm than good and should never be practised even if, following division of the capsule, the outward rotation is better. Eventually these capsular incisions lead to troublesome adhesions, and the results are never as good as when they are avoided. Following the division of the subscapularis the outward rotation is perfectly free, as well as abduction. If at this stage there is still some subluxation of the

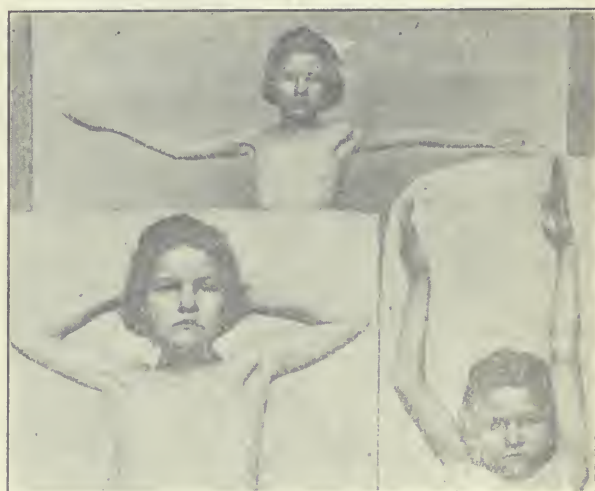


Fig. 4. Mary W. After operation.

The operation merely releases contractions, and gives the stretched and partly paralyzed muscles a chance to recover their tone and strength, and consequently the after-treatment is of the utmost importance. In a certain number of cases it has been found advantageous to divide the pronator radii teres. This muscle is often much contracted and unless released it is a factor in preventing free supination, or tending towards the recurrence of its limitation. This muscle may be easily found and divided by another incision on the upper forearm, subsequent to the shoulder operation.

There have been about 45 cases operated upon now, and in all cases the results are satisfactory. That is, the child has a more useful arm, and the parents are pleased, which while it may not be a surgical factor to be considered is really of great importance in establishing any new method of procedure.



(1) What benefit, if any, has the operation resulted in?

In practically every case that has been operated upon, there has been free and full active outward rotation, as well as increased ability to elevate the arm at the shoulder, depending somewhat on the ability of the deltoid to regain its strength after long stretching and disuse, as well as more persistent residual paralysis in that muscle, which condition cannot be accurately determined beforehand, because of limitation of motion from contractures. Supina-



Fig. 5. Catherine H. Before operation. Left arm.

tion becomes either normal or nearly so. The child can get the hand to the mouth easily, can put it on top of the head and behind the head, which in girls is all important, so as to enable them to arrange their own hair. As a matter of fact, after following several hundred cases for several years, outward rotation and supination are never gained by the most persistent exercise treatment, even when stretching under ether is included.

(2) What are the essentials for a successful operation?

A careful operation with free division of all contractures, and the utmost care in avoiding cutting

the joint capsule. This cannot be too strongly insisted upon. Fixation in a splint and not plaster, which holds the arm elevated to above the shoulder level, abducted and outwardly rotated, with full supination. Fixation not continued for more than the time required to heal the wound, and then exercises, baking and massage at least four times a week, wearing a splint for at least six months.



Fig. 6. Catherine H. After operation. Improved ability to outwardly rotate, supinate and abduct.



Fig. 7. Outlines of both acromions from the front. Note acromial hook on right side.

(3) On what cases should the operation be done?

The best results, as we see them, are in those patients who have had previous massage and muscle exercises, and who have some power in the deltoid and supraspinatus muscles. Treatment in all cases should be begun the first week of life, and the arm should be put in the position of physiological rest—that is, abducted, elevated and outwardly rotated



from the first. Children should not have the arm tied to the side or across the chest, as so often is done at first, as this position encourages and develops contractures of the non-paralyzed muscles. Practically all cases, even those that have had no previous treatment, are distinctly improved, but the convalescence as far as active function goes is slower in those cases that have not had previous massage and exercise treatment. Any case that has contractures, even if only of the subscapularis, is better if that contraction is divided. The operation does

The hand can be supinated, the arm can be outwardly rotated and elevated to above the shoulder level, depending, as said above, on the strength of the deltoid. The hand can be put to the mouth naturally and on top and behind the head to do the hair. At first in some cases—that is, in the first six months or year—there is a persistent inability to adduct or inwardly rotate the arm. This clears up in time and unless the shoulder joint has been opened is no cause of worry. Motion in the shoulder joint is always good in the end, likewise unless the



Fig. 8. Showing elevation of pectoralis major tendon. Cephalic vein to outer side.

less harm than the contraction, and results in a more useful arm.

(4) How long should the after-treatment be continued?

At least six months, wearing the splint night and day for at least three months and daytimes for three months more. Exercises, baking and massage at least four times a week.

(5) What treatment before operation is necessary?

Every case should be given the benefit of the doubt, and should have a long course of at least a year of exercises and massage. In very young children it is better to wait until they are at least three years of age before operation.

(6) What can the child do after the operation that it could not do before?

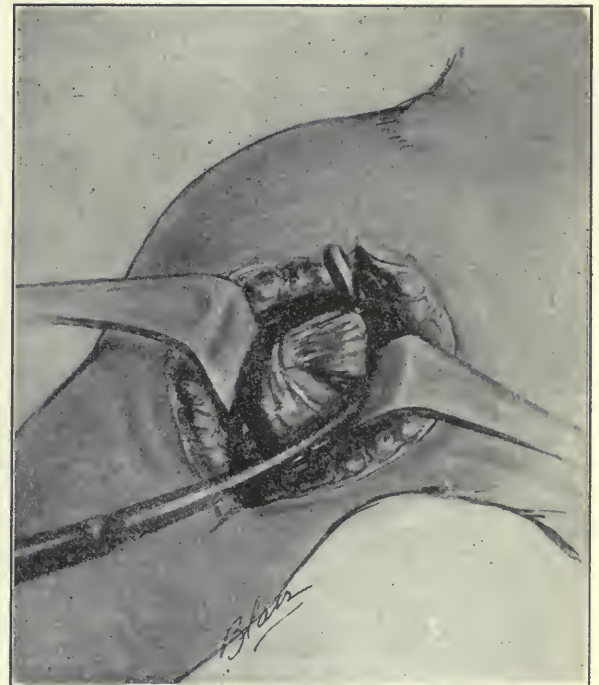


Fig. 9. Pectoralis major divided and retracted. Instrument under tendon of subscapularis. Arm abducted and outwardly rotated.

joint has been opened. A few cases where the joint has been opened have shown a persistent loss of motion in the shoulder and the arm has remained permanently abducted and outwardly rotated, with no motion in adduction. In these cases the free play of the scapula is of great benefit, and allows the use of the arm in a better position, at the expense of stretched rhomboids. The result, however, is not one to be desired, and can be avoided by leaving the capsule intact. Too long fixation following operation, without exercises and massage, will also lead to slow recovery of motion in rotation and adduction.

#### PROGNOSIS.

The prognosis in all upper-arm type of cases is good, provided the case is watched from the start, and treatment is properly carried out. The patients are practically all able to raise the arm to the shoul-



der level and can use the hand and lower arm well, except for varying degrees of supination. Abduction and outward rotation are rarely regained without division of the contracted muscles, provided they have been allowed to contract.

In the lower-arm type the outlook is not so good, although many of the patients regain use of the upper arm in spite of the persistent paralysis of the lower arm and hand. These cases should all be explored for repair of the plexus as far as possible, but even then very little hope can or should be held out to the parents. The general principle of treatment, however, should be carried out over a long period of time. Much can be done along orthopedic lines for these patients, and they should not be generally neglected as they have been in the past, with the statement that nothing can be done, or that they will get well of themselves.

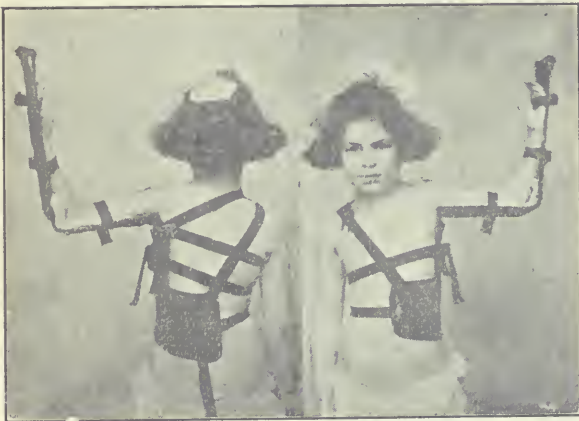


Fig. 10. Front and back view of splint used after operation.

#### CONCLUSIONS.

Obstetric paralysis is due to stretching or tearing of the cervical roots of the plexus brachialis. It occurs in boys as frequently as in girls. It occurs more often on the right than on the left side.

The upper-arm type is much more frequent than the lower-arm type. Affection of both arms is very infrequent.

It is practically always associated with a difficult labor, in which ether and forceps have been used and force has been applied. Not uncommonly is the baby asphyxiated.

Head presentations show the larger percentage of occurrences of both types of cases.

It may rarely be associated with fracture of the clavicle, but it is not the result of a fractured humerus or a dislocated shoulder joint.

The prognosis for a useful arm is good in the upper-arm type, and bad in the lower-arm type.

#### FIXATION BY A WOOD SCREW WITHOUT ARTHROTOMY IN CERTAIN FRACTURES OF THE NECK OF FEMUR.

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On May 10, 1920, I saw with Dr. John A. Broadfield, a patient he had sent into the Northeastern Hospital with a fracture of the neck of the left femur from a fall about four weeks before. Two days after the injury he was taken to a hospital where he refused to stay longer than two days, during which an x-ray picture was taken, after which he was treated at home. As soon as Dr. Broadfield saw him he advised hospital treatment. He was 60 years of age and some years before had sustained an amputation about the middle of the right thigh. He had been earning a good living as a maker of instruments used by artists and draughtsmen and a good functional result from the fracture of the femoral neck was a matter of much importance to him. The delay of four weeks in beginning treatment was a formidable disadvantage in obtaining bony union. I had been impressed with Delbet's idea of passing a screw through both fragments from the external surface of the great trochanter without arthrotomy, but I had trouble then and have not yet succeeded in finding a satisfactory description or illustration of his method. He depended upon traction for the correction of the displacement of the fragments before introducing the screw and insisted upon the use of a specially devised apparatus for the accurate placing of the screw.

Whitman's abduction method, in my opinion, is decidedly the best for the correction of the displacement and close, accurate approximation of the fractured surfaces. A screw passed through both fragments should prove a valuable help in obtaining bony union after so long a delay in beginning Whitman's treatment. After some thought I conceived the following plan of combining the advantages of the Whitman abduction cast and the screw: On the day following admission to the hospital the patient was etherized, the limb forced into abduction and a cast applied extending from the lower margins of the ribs to and including the foot. A roentgenogram on the following day showed good alignment and approximation of the fragments. A large hole, about six inches from above downward and about eight inches in the long axis of the limb, with the center of the opening about over the great trochanter, was cut in the cast. On May 14th, the patient was etherized and this small exposed skin area prepared for operation



in the following manner: The surgeon gowned, masked and gloved, with a gauze sponge held in a long hemostatic forceps, first washed the skin with ether. Then with another forceps he pushed the edge of a sterile towel under the upper edge of the cast opening and lapped the towel upward over this margin. Each of the four sides of the opening was prevented from contaminating the skin of the operation area in a similar manner. With the edges of the opening thus draped, the rest of the body was covered with sterile sheets in the usual manner, as shown in figure 3. After painting the skin with tincture of iodine and washing this off with alcohol an incision

the roentgenogram carefully one can determine accurately enough the distance below this landmark at which the screw should be introduced and can decide the angle at which it should be held while driven in to follow approximately the center of the neck in the sagittal plane. I determined the necessary length of the screw by the length of the *x*-ray picture of the femoral neck, but did not allow for the fact that the roentgenographic shadow is larger than the object, because the plate is some distance from the object when it is exposed to the rays. I believe that this largely accounts for the passage of the screw through the head into the acetabulum in this and the



Fig. 1. Case 3, before operation.

from 3 to  $3\frac{1}{2}$  inches long was made over the most prominent portion of the great trochanter in the long axis of the limb, (see scar in figure 4) through the skin and fascia. Then a sterile towel was clamped to the edge of the wound on each side thus further protecting the wound from infection. The wound was then deepened to the bone which was freed from the overlying tissues well to each side, exposing the anterior and posterior margins of the great trochanter.

The advantage was not recognized in this or the second case of the prominence on the outer surface of the trochanter as a landmark, and the screw was not as well placed as in the other two cases. This landmark is easily seen in the roentgenogram and found on the bone in the operation. By studying

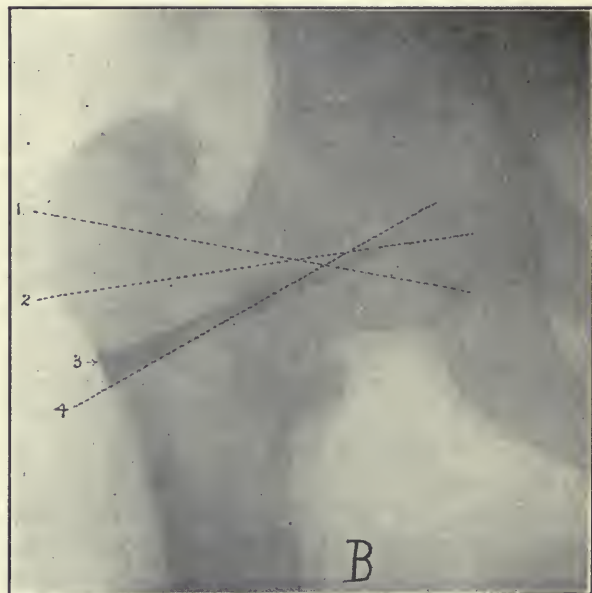


Fig. 2. Case 3, after operation, showing screw penetrating both fragments only slightly below the axis of the neck. An effort was made to show by dotted lines the approximate positions of the screws, a number being given to each to correspond with that of each of the cases here reported. For example, line number 1 shows approximately the position of the screw in case 1, although this screw was placed much nearer the center of the neck than indicated here. The three-quarters of an inch shortening in this case accounts for much of this discrepancy. Note the successive improvement in the judgment of the direction and length of the screw due to the recognition of the important bony landmark and the fallacy of depending on the *x*-ray plate in determining the length of the screw.

second case. Allowance should be made for this by using a screw a half to three-quarters of an inch shorter than the distance from the external surface of the trochanter to the surface of the middle of the head on the *x*-ray plate. We probably have no means of determining whether the screw in any of these cases will leave the neck anteriorly or posteriorly. A suitable *x*-ray exposure for its determination seems impossible. I have not concerned myself much about this phase of the subject since the



cases have been operated upon, because of the excellent results obtained and before the first operation it seemed to me very unlikely that the screw would leave the bone in front or behind. When the foot occupies the vertical position with relation to the leg, i. e., is neither turned inward nor outward, the plane of the neck in the recumbent position will be almost horizontal, but will have a slight forward projection (about 12 degrees according to Whitman). If the screw is introduced about midway between the anterior and posterior borders of the great trochanter with a slight inclination forward there will be very little likelihood of its emerging from the bone anteriorly or posteriorly. But, for the sake of argument, let us suppose that it did so emerge, what harm could it do? If it had a good hold of the inner or small fragment I should have little concern. It can be removed easily later if it gives trouble.

After selecting the point for the introduction of the screw and placing it in what I considered the proper angle from a careful study of the *x*-ray picture, it was driven in about halfway by a mallet and for the remaining distance by a large screw driver. In my first case I drilled a preliminary hole for the screw, but later found that it was easy and satisfactory to drive the first half of it through the cancellous tissue of the trochanter. The last half was forced in by a screw driver in order that it might get a better grip on the inner fragment and make a tighter approximation of the two fragments. The wound was then wiped out with a little dichloramine-T and closed completely. A dressing was applied and the cast and its opening reinforced by several plaster-of-Paris bandages. In not one of the four cases did the slightest sign of infection develop.

Phocas in one case had the help of Cara, an assistant of Delbet, in applying the Delbet apparatus for the accurate placing of the screw and of this case Phocas said that the *x*-rays afterwards showed the screw a little too low, not passing in the axis of the head, and extending through the head and encroaching upon the acetabular cavity. Delbet, in discussing this case, did not see any disadvantage in the deviation of the screw nor did he criticise its encroachment on the acetabulum. According to my own experience this is a matter of minor importance and probably interferes little or not at all with the permanent value of the operation.

CASE I. This case has already been described up to the completion of the operation. There was no disturbance of the wound afterward. He was discharged from the hospital two weeks after operation to lie in bed at home under the care of Dr. Broad-

field, who removed the cast at the end of nine weeks. Gradually he became accustomed to his crutches again and about five weeks after the removal of the cast he began to follow his usual occupation which required frequent rising from the sitting position and walking about the room on crutches. He was soon able to do as much work as before the fracture and has done it ever since. On July 13, 1921, under anesthesia with nitrous oxid and a little ether the screw was removed and after two days he left the hospital. Before the screw was removed he could flex the hip to about a right angle, but beyond this he would develop pain. At this time roentgenograms showed that the end of the screw had worn away a portion of the bone in the acetabulum by its movements. There is no eversion of the foot and he can turn the foot inward and outward almost to the normal degree. He has normal use of the limb except for the slight pain on forced movement due to the projection of the screw into the acetabulum.

CASE II. Woman, 65 years old. Thin, pale and weak. Fell down stairs about July 27, 1920, and fractured neck of left femur. Treated by Buck's



Fig. 3. The hole cut in the cast is here shown draped and ready for the making of the incision and introduction of the screw.

extension and sand bags at home until admitted to the University Hospital, October 27, 1920 (13 weeks after the fracture occurred). Whitman abduction cast applied November 2nd. Screw introduced November 17th, and patient sent home to lie abed in cast until December 20th (33 days after the screw was introduced). Returned to hospital January 27, 1921, to have the cast removed (10 weeks after operation). Roentgenogram seemed to show bony union. Sent home again February 2, 1921. Remained in bed at home without cast about two months before attempting to get out of bed on account of weakness and timidity. Then increased her stay out of bed gradually for about a month when she began to use crutches and then required about two months more to come downstairs. At the present time, July 14, 1921, she flexes the hip joint about 70° and the knee nearly to right angle. Complains of no pain in knee or hip. Tried first time to walk without crutches and took about a dozen steps timidly but without pain. Holds foot of affected side in about same degree of eversion as normal foot and can turn foot



into inversion well past the midposition. Frequently goes about with one crutch.

CASE III. Russian immigrant, 42 years old. Strong and healthy. About August 15, 1920, a horse running away, he was thrown from a farm wagon, injuring his left hip. About three weeks later he was taken to a hospital in a neighboring town where an x-ray picture was taken and he was told that there was no fracture. He seems to have been put up in a Buck's extension indicating a suspicion of fracture, and remained therein some weeks. He was admitted to the University Hospital, December 4, 1920, with a



Fig. 4. Case 3 is here shown demonstrating his ability to flex his left hip and knee joints while sustaining his weight upon his feet. The right or normal limb is capable of still more flexion in both joints. Note the scar of the incision and the absence of eversion in the left foot, which was characteristic of all four cases.

considerable indurated swelling in the region of the left hip which, in view of the negative x-ray report, was suspected of being a sarcoma. An x-ray picture taken at the University Hospital showed clearly a fracture of the femoral neck (see figure 1), and he was transferred to the fracture service. In view of the long period that had elapsed since the accident it was considered advisable to introduce the screw. The abduction cast was applied December 12th and the screw introduced December 21st. The cast was removed February 28, 1921, 9½ weeks after the screw was introduced. Five days later he was walking with crutches and could take nearly his whole weight on the foot of the injured side. Discharged March 9, 1921. Readmitted to the hospital July 5, 1921. He walks easily and quickly without pain, but with a slight limp due chiefly to some limitation of movement at the hip and knee joints although he can force these movements almost to the normal (see figure 3).

CASE IV. Man, 33 years old, oyster opener. On February 26, 1921, while delirious from pneumonia jumped from a second story window landing on a cement pavement below. His chief injury was a com-

minuted intertrochanteric fracture of the neck of the femur. Because of his lung condition it was impossible to correct the considerable deformity since he could not take a general anesthetic until March 30th, (32 days after occurrence of the fracture) when the Whitman abduction cast was applied. The screw was introduced April 11th, and the cast reinforced at the hip. He was allowed out of bed in a wheel chair in the reclining position April 26th. The original cast was removed and a new one allowing the limb to be adducted as far as possible applied on May 9th. Two days later (30 days after introduction of the screw) he began to walk on crutches. May 13th, he first stood on both feet without the crutches or other support, with the cast on, and then took his whole weight on the foot of the injured side without experiencing any pain at the hip. He was then advised to walk as much as possible without crutches. Cast removed entirely eight weeks after screw was introduced. On July 15th he reported that he had used a cane only two days after the removal of the cast and had been going about ever since without support. He walks easily without pain but with some limp. His chief trouble comes from stiffness at the knee which he can flex only about 10°, He can flex the hip to about a right angle. Could have returned to work as an oyster opener a month ago but it is out of season and he can get no other suitable work.

#### CONCLUSIONS.

1. The screw as here employed is beneficial in cases too long deprived of the advantages of the Whitman correction of displacement, close approximation, and fixation of the fragments.
2. Its introduction by means of the technic described is safe and sufficiently accurate for the purpose intended.
3. The chances of infection are almost nil.
4. The patient, if young enough, may be permitted to get about on crutches with the cast on at the end of 4 or 5 weeks following the introduction of the screw. This will prevent any displacement of the fragments and the weight-bearing will favor the more rapid and certain development of bony union.
5. More time is necessary for final judgment in any of these cases but enough good has been accomplished in all to warrant further trial of this method of treatment in selected cases.

When operating for osteomyelitis of the fibula in children, it is advisable at once to perform subperiosteal resection of the affected length of the shaft.

That a bone appears normal by fluoroscopy does not gainsay a fracture. An x-ray plate may show it when the fluoroscope fails to do so.



## OPERATIVE TREATMENT (ARTHRODESIS) FOR OSTEO-ARTHRITIS OF THE HIP.

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Osteoarthritis of the hip is a chronic condition which attacks young and middle-aged as well as the aged. It is characterized clinically by a slow and gradual onset, absence of fever, local pain, muscular spasm and wasting, stiffness, disability and deformity, never presenting any tendency to suppuration. It may or may not be associated with similar conditions in other joints. It may be implanted upon an old healed destructive arthritis such as tuberculosis.

The etiology of this affection is still obscure. It has been ascribed to exposure, traumatism and some chronic infection in which injury certainly plays some part. I am convinced from a large experience and careful study of many cases and the statistics of others, that old age plays a minor part only in its etiology.

At the International Congress, Budapest, 1909, I reported in detail 14 cases successfully operated upon; of these six were thirty years old or younger.

Whether the initial lesion of arthritis deformans is in the synovial membrane, the cartilage, or the bone, is a matter still in dispute. Schuller has described a bacillus found in these joints, with which he has been able to produce similar lesions in animals. His results have not been confirmed. Dor has injected attenuated cultures of the staphylococcus into joints and produced lesions quite similar.

Early in this process the synovial fluid is increased, later it becomes diminished, and may almost disappear. Changes in the cartilage occur early, cells multiply and the hyaline substance degenerates. The hyaline cartilage takes on a yellowish appearance and the articular surfaces become thinned in the center, finally disappearing entirely. The head of the bone thus laid bare becomes smooth, polished and eburnated. The affection is characterized by destruction and absorption. "Marginal ecchondroses or osteophytes appear and may become so large as to perforate the synovial membrane and become pedunculated or even detached, and appear as loose bodies in the joint. The head of the bone may become locked in the grasp of these bony outgrowths and motion be greatly interfered with, so much so

that much wearing away of the head does not take place. On the other hand, if motion continues, the head may become flattened and in some cases almost entirely worn away, thus exposing the Haversian canals and presenting a worm-eaten appearance".

"The acetabulum is deepened both by the wearing away of its floor and the ossification of the cotyloid ligament. In any event the motions of the hip are much limited and tend toward that of a cylindrical joint, on account of its anatomic changes".

The head wears away more and more and the marginal outgrowths progress toward the trochanter. In addition to this, the neck hypertrophies and may bend, thus forming more nearly a right angle with the shaft than normal. This event, as well as the



Fig. 1. Photograph of a brace which had been worn for 9 months by case G. D. It weighed 12 1-2 pounds and the patient claimed that the discomfort from it was as bad as the disease.

wearing away of the acetabulum and the flattening of the head, results in an elevation of the trochanter above Nélaton's line and a consequent shortening of the leg. This actual shortening varies a good deal and averages about one-half of an inch. Further than this, a very important feature is the consequent practical shortening and its resulting disability, resulting from the deformity of adduction and flexion.

From an x-ray standpoint this condition differs greatly from that of tuberculosis or any other type of arthritis. Contrasted with the rarefaction and disintegration of tuberculous arthritis, this condition shows great increase of density of the elements of the joint from eburnation and the accumulation of osteophytes around the superior, and usually also



the inferior, margin of the joint, associated with varying degrees of flattening of the head.

The onset is insidious, with pain in and about the joint, often shooting down the course of the sciatic nerve or in many instances to the region of the knee. Motions of the joint beyond a certain arc are painful. External rotation, abduction and hyperextension are particularly painful and later in the course of the disease are much limited. Muscular atrophy comes on early, and the buttock of the affected side becomes flaccid and flattened. The arc of motion gradually diminishes until finally the joint may become entirely stiff, from a functional standpoint.

The severity of pain and the amount of effusion in the joint varies within wide limits. A peculiar crepitation produced by the rubbing of the rough-



Fig. 2. Roentgenogram of the affected hip of G. D. before operation.

ened synovial membrane and osteophytes may be present when the leg is manipulated. Motion may be almost or entirely lost either from muscular spasm, grasp of the surrounding osteophytes, disappearance of the synovial membrane, or flattening of the head of the bone. A very important diagnostic point is the fact that if motion exists in the advanced cases it will be practically in one plane, that of flexion. The earliest limitation of motion is in abduction and rotation. This is explained mechanically, as above, by changes that make the joint, instead of spherical, practically a cylindrical one. Flexion may be moderately limited, whereas abduction and rotation may be nearly absent. No other condition, with slight bony shortening, produces this symptom-complex.

*Summary of Clinical Features:* Briefly, the clinical

manifestations of osteo-arthritis (arthritis deformans) of the hip are:—

“(a) Insidious onset.

“(b) Symptoms manifested only during locomotion.

“(c) Motions of the hip change from those of a ball-and-socket joint to those of a hinge-joint.

“(d) The axis on movement of this hinge-joint in flexion is always obliquely outward, and varies in its obliquity to the antero-posterior plane of the pelvis in different cases.

“(e) Muscle spasm, on passive motion, may be entirely absent.

“(f) Marked contrast of the x-ray appearance to other conditions which simulate it clinically.

“(g) The frequency of trauma as an etiological factor”. (Albee, *Orthopedic and Reconstruction Surgery*.)

Partial temporary relief may be secured by rigid regulation of the patient's habits and occupation, especially by keeping him off the limb. Local massage, friction and manipulation of the joint in abduction and extension with or without an anesthetic may halt the progress of symptoms. A focus of infection, of which the hip condition may be secondary, should always be carefully sought for and, if found, should be eradicated, if possible. Vaccines made therefrom and systematically administered, rest in bed with traction apparatus, if necessary, will do much toward relieving discomfort temporarily. The stiffness in the early stages is due to muscular spasm and not to ankylosis, and is diminished, therefore, by any measure that protects the joint. Traction is indicated when passive manipulation is painful and restricted by muscular spasm. The patient should lie in bed with weight and pulley arranged as for ordinary hip disease. The weight, approximately ten pounds, should pull in the normal direction of the leg unless pain is caused or excessive malposition of the leg exists. In either event the traction should be in the line of the deformity.

It is rare that much can be accomplished by braces. It is the usual conclusion of the patient that the treatment by braces is as bad as or worse than the disease (see figure 1). This is due to the unfortunate difficulty of efficiently bracing the adult hip joint without undue discomfort to the patient.

Where the condition is at all advanced with marked anatomical and pathological changes, such as wearing away of the top of the femoral head and acetabulum, osteophytes and the associated flexion and adduction deformity, satisfactory results can



rarely be obtained, short of the operative treatment about to be described.

Complete resection of the head and neck as practiced by Hoffa is not to be recommended. It is rarely possible in the most carefully selected cases to get relief from forcible manipulative procedures under ether. Baer, in 1913, recommended arthroplasty to preserve mobility in certain cases of this type. This consisted of resecting a considerable portion of the femoral head, including the osteophytes. In most cases he did not place any material, such as prepared pig's bladder, between the femoral head and acetabulum. Since this report I have carefully selected and operated upon four cases by this method. The results in all of these cases have not been as satisfactory as those obtained by the arthrodesis operation in the single hip involvement. Pain in a varying degree has persisted. At the same time I have successfully been employing mobilizing arthroplastic operation for other hip conditions with ankylosis.

There is hardly any operation that gives a larger percentage of very grateful and satisfied patients than the arthrodesis, devised by me and first reported in the *Journal of the A. M. A.*, June, 1908.

To date, 128 cases have been operated upon with very gratifying results.

#### ILLUSTRATIVE CASE.

G. D., a policeman, 52 years of age, and weighing 220 pounds; consulted me September 1, 1919, and gave the following history: For four years he had had pain in the left thigh and knee; he had noticed also that the limb had become short and stiff at the hip. At first he experienced pain only when walking. Later the pain became much more severe, both by day and by night. He received much treatment of a large variety. Nine months before he had an extension brace made (see figure 1) which he found gave him no relief. This brace weighed 12½ pounds and extended from the foot to above the costal margin on his trunk. He stated that this brace had added to his discomfort but had given no relief. Many patients suffering from the same condition have made the same statement to me. Figure 2 is an *x*-ray picture of this case. He was operated upon at the New York Post-Graduate Hospital, September 13, 1919.

With the patient in the dorsal position on the Albee fracture-orthopedic table, the feet were covered generously with plaster cotton and bound to the traction foot-pieces with 4-inch muslin bandages. The hip-joint was reached by the Sprengel or Smith-Pedersen approach. The skin incision was made along the crest of the ilium from a distance five inches posterior to the anterior spine forward to the anterior superior spine itself, and then straight down for a distance of 4 inches. The fascia lata

was cut parallel with the crest of the ilium and about half an inch below it, thus furnishing a means of suturing the fascia to the crest of the ilium when closing the wound. The gluteus minimus and medius and tensor vaginae femoris muscles were then separated subperiosteally from the side of the ilium by means of a broad osteotome, and carried downward to the superior surface of the hip-joint. The proposed triangular skin and muscle flap was then completed by blunt dissection down from the anterior superior spine and just outside of the sartorius muscle. This gives the best exposure of the hip-joint.

The joint capsule was then laid open by a T-shaped incision, the top of the T being parallel to and just below the rim of the acetabulum. By attempting to rotate the femur in and out, a close inspection of the joint confirmed the *x*-ray findings,

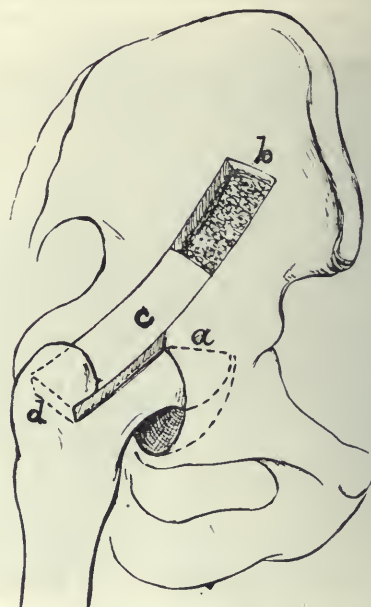


Fig. 3. A diagrammatic drawing to illustrate the author's latest technic in the operative treatment of osteoarthritis, selected cases of tuberculosis and flail paralytic condition of the hip.

namely, that there was a rim of osteophytes extending from the edge of the acetabulum and also from the outer rim of the femoral head. The synovial membrane and hyaline cartilage were largely absent from the top of the femoral head, in fact, this portion of the head had the well-known worm-eaten appearance caused by the bone being actually worn away after the loss of the cartilage. The bone was also polished and glittered like marble.

With a broad chisel and a mallet a large portion of the osteophytes on the rim of the acetabulum was removed; and with the same instruments about one-fifth of the top of the head of the femur was removed through a plane sloping inward and upward, and, also with the same instruments, the top of the acetabulum was transformed into a flat surface (figure 3, a). While the femur was being rotated strongly inward and outward, all accessible cartilage was removed from the remaining portion



of the femoral head. This allowed the freshened plane surfaces of the femoral head and the acetabulum to come nearer together, though not in close proximity.

The table was then adjusted so as to bring the foot straight up, and the limb was abducted at the hip about  $10^{\circ}$  and flexed about  $10^{\circ}$ . The digital fossa on the inside of the trochanter was then deepened by means of a narrow osteotome and mallet, thus making a groove about  $\frac{1}{2}$  inch wide and about  $\frac{3}{4}$  inch deep in a plane parallel with the outer surface of the ilium just above the acetabulum (figure 3, d).

With the point of a scalpel, a large graft was then outlined in the periosteum on the outer surface of the ilium,  $3\frac{1}{2}$  inches long by 2 inches wide, its lower end including the superior rim of the acetabulum. With the Albee motor saw the graft was then cut

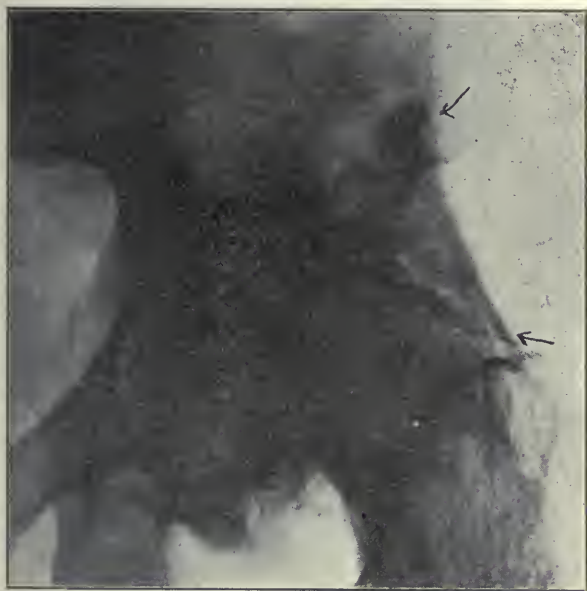


Fig. 4. Roentgenogram of the hip of G. D. after operation, showing complete bony consolidation of the graft, head of femur and acetabulum. The arrows indicate the sliding inlay graft brought down from the outer table of the ilium just above the hip joint and inlaid into both the ilium at and above the acetabulum and the neck and trochanter of the femur.

through the outer cortical table of the ilium according to the pattern outlined. It was then removed from its bed with a broad thin osteotome.

If care is not exercised in this work the inner cortical table of the ilium will be damaged or a portion of it removed.

The large rectangular graft thus obtained was turned end to end, and what was the upper end was thrust firmly into the groove in the upper end of the femur, the other end being placed in the lower end of the gutter formed by removing the graft, as shown in the diagram (figure 3, c).

In a way, this is another application of my inlay graft which I have so frequently used in ununited fracture of the long bones.

Attention should be called to the change in the technic of this operation from that originally practiced by me. In the first cases, done some 15 years ago, great care was taken to remove from the wound all loose fragments of bone. In fact a special fountain douche apparatus was devised to wash out all bone fragments from the hip. Now a large graft is used and favorable fragments of the femoral head are put back again to serve as additional foci of bone growth. This illustrates the modern conception of bone growth and is far-reaching in its application and results.

The wound was then closed with a continuous suture of chromicized catgut in the fascia, and a continuous suture of No. 1 plain catgut in the skin. The approximation of the affected muscles against the side of the ilium thus secured was very gratifying.

It may be noted that this approach does very little damage to the muscles or their enervation or other soft parts of the hip, and its introduction constitutes almost an epoch-making event in the plastic surgery of the hip-joint. I use this approach for all plastic operations upon the hip-joint, reserving the anterior incision for approaches to the neck of the femur only.

The suture holes in the skin were then puddled with  $3\frac{1}{2}$  per cent tincture of iodine, extensive dressings of gauze and absorbent cotton were placed over the incision, and a long plaster-of-Paris spica was applied from the base of the toes to 2 inches below the costal margin on the right side and 3 inches above the costal margin on the left. This splint was worn for a period of eight weeks, after which an x-ray plate indicated firm union of hip-surfaces and graft. The patient was allowed up and about on crutches, bearing some weight on the foot.

The subsequent convalescence of this patient has been most satisfactory, in that all pain has ceased, and he takes a rather paradoxical view of the result of the operation, for he says he has more motion of the hip now than before the operation.

This attitude of the patient has been noted in a number of other cases, and is accounted for by the fact that the absence of pain overcomes the muscle spasm at the lumbar spine, knee, etc., to such a degree that compensatory action of the surrounding joints is surprisingly restored. Although the operation destroys the motion of the particular joint, nevertheless, from the point of view of the patient, the results are brilliant. Figure 4 is a roentgenogram of this case six months after his operation. The arrows point to the inlay graft slid down from the outer table of the ilium.



ARTHRODESIS FOR LOSS OF HEAD AND  
NECK OF FEMUR. A CASE REPORT.\*FRANCIS W. McGUIRE, M.D., F.A.C.S.,  
BUFFALO, N. Y.

Auto-transplantation of the head and part of the shaft of the fibula has been successfully performed for loss of the head and neck of the femur. Its success, however, is not accomplished without a great deal of discomfort to the patient, such as treatment extending over a period of from one and one-half to two years, long confinement in bed, inability of the patient to use the leg as a weight-bearing member for at least a year and at times failure due to absorption of the graft.



Fig. 1. Fracture with absorption of the neck and greater portion of the head of the femur.

On account of these inconveniences, I concluded to try another procedure for the relief of this condition. This consisted in the removal of the top of the great trochanter, the acetabulum and the outer compact table of the os ilii until cancellous bone was reached. This operation and patient I present here for consideration.

Miss L. C., aged 26, a patient of Dr. Paul, was referred to me May 20, 1919.

She had had the usual diseases of childhood, but otherwise was well until September, 1916, at which time she was operated upon for appendicitis and uterine trouble. Her recovery from this operation was uneventful and she remained in good health for a period of nine months, but at the end of this time she became very nervous. In September, 1917, she fell from the second story window, fracturing the neck of the left femur, and was treated for eight weeks by the use of Buck's extension. She was

then up and about on crutches and later used a cane until I saw her in May, 1919.

*Examination:* The patient was well nourished and weighed about 135 pounds. Pupils reacted normally to both light and accommodation. The mouth and teeth were in exceptionally good condition. The heart and lungs were normal. The reflexes were normal. The abdomen showed a transverse scar in

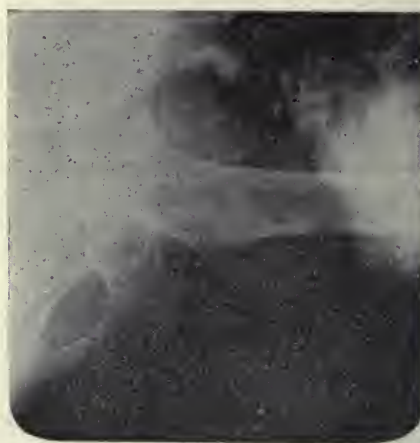


Fig. 2. Thigh at right angles to body in plaster cast.

the lower part due to previous operation. There were no herniae present. The left leg was three and one-half inches shorter than the right with the patient in the recumbent position. Pressure made against her foot increased the shortening two inches. The Wassermann reaction was negative. X-ray examination showed a total loss of the neck and almost complete loss of the head of the left femur.



Fig. 3. Condition when patient left hospital, August, 1919.

*Operation:* May 26, 1919, under gas anesthesia. A U-shaped incision was made over the left great trochanter and the skin and fascia turned upward. A chain saw was passed around the upper end of the great trochanter and this portion of the trochanter sawed off. By this procedure, the obturator internus and piriformis muscles attached to this bone were reflected and we were brought immediately down

\*Read before the Buffalo Academy of Medicine, March, 1921.



upon the false joint which had been produced by absorption of the bone. It was found that the neck of the femur was entirely gone and only a small portion of the head remained. This was so soft that it



Fig. 4. Eighteen months after operation. Thigh in abduction with tilting of pelvis.

was considered to be of no value—any operation done with the object of connecting the remaining portion of the head with the trochanter would have proved a failure. I then decided upon the following



Fig. 5. Sitting posture.

operation as the one most advisable:

The head and cartilaginous tissue were removed from the acetabulum and the upper half of the acetabulum was gouged out until the cancellous bone of

the ilium was reached. By this procedure, I had secured a shelf against which the sawed end of the trochanter could rest and act as a support to the body. I then placed the end of the trochanter into the socket, after freshening the outer surface of the trochanter so that I could replace the part that had been removed earlier in the operation. This piece of bone was sutured in place with chromicized catgut. At this point I also made sure that there was ample room for the thigh to move anteriorly and posteriorly so that the patient could walk about and also sit comfortably on a chair. The thigh was placed at right angles to the body, the wound closed and a body cast of plaster was applied. The cast was removed at the end of six weeks and during the next seven days the extremity was gradually brought parallel with the right. At the end of nine weeks the patient was out of bed and about the room on crutches. She left the hospital August 11, 1919. At the end of one year she walks without crutches or cane and has a very useful extremity with  $1\frac{1}{2}$  inch shortening. The accompanying cuts will serve to illustrate her present condition.

This operation, I believe, has the following advantages:

1. It is more likely than others to be successful.
2. It does not confine the patient to bed a great length of time.
3. The patient has a useful extremity.

I am sure that if extreme abduction as described by Whitman is used in this type of fracture, absorption will rarely, if ever, take place.

#### TESTING NERVE FUNCTION.

When testing pin-prick the pressure of the pin should always be accompanied by that of the pad of the observer's finger; otherwise the patient will find it hard to distinguish between the pressure of the pin and its painful stimulus, with much consequent waste of time. The pressure sensation evoked by the pin is part of the deep pressure sense, and dependent on different fibers from those responsible for the epicritic pain sense. In our experience the deep pressure sense returns sooner, and is lost less often, than the epicritic.

In testing Tinel's sign, care must be taken not to be misled by tingling from an adjacent nerve, as in so many regions two or more have an identical course, e. g., the ulnar and internal cutaneous in the upper three-fourths of the arm. By asking the patient to mark out the peripheral distribution of the tingling, this error is avoided.

Muscle tenderness is sometimes hard to tell from nerve tenderness where the nerve runs through the muscles it supplies, as the ulnar does in the palm of the hand.—M. FORRESTER-BROWN in *The British Journal of Surgery*.



## THE TREATMENT OF FEMUR FRACTURES

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From a purely statistical viewpoint, how much more serious than many other surgical conditions is the fractured femur! A simple appendectomy wound heals in seven to ten days, that of a suppurative case in six to ten weeks; a cholecystectomy case is cured in six weeks or less, and, if drained, in ten to twelve weeks at the utmost; intestinal anastomosis, or gastro-enteric-anastomosis are restored to function in three to six weeks, while a well-treated, properly healed femur fracture, as a rule, takes six months before the resumption of the artisan's occupation can be undertaken.

As Sir Robert Jones ably states, "fractured femurs were the great calamity of the war", so also are they the great calamity and problem of the industrial warfare for sustenance.

Fractures of the femur can be classified in two general ways:

1. According to the extent of the lesion, as,
  - (a) Simple, or
  - (b) Compound.
2. Anatomically, as,
  - (a) Of the upper third;
  - (b) Of the middle third;
  - (c) Of the lower third;

and their treatment will vary accordingly.

Certain essential objectives must be kept in view in the treatment of all of them. Briefly stated, they are:

1. The attainment of complete reduction, if possible.
2. Firm bony union.
3. Keeping the correct relations of the anterior planes of the upper and lower fragments.
4. The prevention of shortening (a good result, according to the report of the Fracture Committee of the American Surgical Association, should show no shortening of over one-eighth to one inch).
5. Prevention of lameness, due to knee stiffness or shortening.
6. The restoration of the patient to efficiency as a workman, in the minimum time commensurate with proper union. This can seldom be attained in less than six months.

As basic principles of treatment, to gain these results, the following two rules should be axiomatic:

1. The distal fragment is the mobile one and must, by one method or the other, be brought into

axial relationship with the proximal fragment and maintained there.

2. The limb must be put into the posture of neutral muscle pull. There will then be less tendency to displacement.

All traction or fixation should at all times be carried out with these two basic factors in view.

Two other fundamental principles that are of tremendous importance should be recognized.

1. Frequent *x-ray* examination should be the rule. Fragments slip, traction is not sufficient; malformation is the result. The *x-rays* will readily demonstrate such a defect.

2. Whenever a fracture is put up in traction, such as obtained by a Thomas splint, daily inspection of the conditions present should be made. The mere application of a traction apparatus is only the beginning of the treatment. The painstaking subsequent after-care of these fractures is the only sure way of obtaining proper results. To allow such an apparatus to go without inspection for a month or more, as I have frequently witnessed, will, in nearly every instance, eventuate in malposition or malunion.

At all times the surgeon should familiarize himself with the anatomy of the region involved in the fracture, and the various forces acting upon the fragment, and be ready to adapt new principles or variations of the old to bring about results. These conditions are best met by careful *x-ray* study, and it is for this reason that I shall not here enter into a discussion of the processes involved in the so-called typical fractures, nor shall I attempt to exhaust the various methods that may be employed and discuss their relative value. Certain definite facts have impressed themselves as common to the treatment of each region, and it is from this viewpoint that the treatment of the individual fractures will be considered. This will explain certain apparent omissions of methods that have been effectual with other workers.

*First-Aid Treatment.*

The treatment should be begun as soon as possible after the injury. Proper emergency care means the prevention of deformity and bleeding into the muscles and fascial planes, with subsequent hematoma, myositis, or nerve injury. This is best effected by the early use of the Thomas splint, that is, prior to any attempt at transportation of the injured individual.

The splint should be applied over the clothing and traction begun immediately. This can be effected by one of two methods:



(a) By splitting laterally through the uppers of the shoes at their junction with the sole, and then passing a bar of metal or wood transversely under the arch of the foot, through the shoe. This bar should rest upon the side pieces of the Thomas splint; to it, on each side, should be attached extension strips running to the V-shaped end of the Thomas splint and tied there. A posterior splint of some sort should then be applied and the whole limb bandaged from the ankle to the groin. The splint should be suspended so that the heel does not rest upon the stretcher.

(b) A second, but inferior, method of obtaining extension is by the use of a rope tied in a clove-hitch over the foot, with the Spanish windlass form of traction.

A number of special emergency extension devices have been invented, but, as a rule, these are not available at the time of fracture. We have found an Esmarch's tourniquet to be satisfactory. A piece of inner tubing from an auto tire will answer the purpose.

#### *Hospitalization.*

All cases of fracture should be placed in hospitals for treatment, as their care requires frequent examinations, adjustments, and Roentgen pictures, all of which cannot well be obtained at home.

#### *Immediate X-Ray Examination.*

An x-ray examination should be made immediately in every case, both before and after the splint is applied. This will demonstrate the immediate pathology and aid in obtaining proper alignment of the fractured ends.

#### FRACTURES OF THE UPPER THIRD OF THE FEMUR.

##### *Fractures of the Neck.*

*The Intertrochanteric Type.* These types of fractures can readily be developed into those of (a) the aged, or asthenic variety, and, (b), the adult or sthenic variety. In industrial surgery, the former types are rare and we shall not discuss them here. As a whole, they are unsatisfactory cases to treat, and might well be a subject for study by themselves. The latter type can be properly managed by either the Whitman abduction method or the combination of the Cotton with the Whitman method. If impacted and not in proper position, (remembering that we are dealing with the industrial type of case) the impaction should be broken up. This is best effected under anesthesia, the patient being placed upon a Hawley or Albee table.

Stated briefly, the various steps in the Whitman method are the following:

1. Traction and extreme abduction of the leg.

2. Rotation of the leg inward, bringing the trochanter forward.

3. The elevation of the trochanter by pressure from behind.

4. The application of a plaster spica extending from the toes to the nipple line, the leg being held slightly inverted and strongly abducted. A "dinner pad" should be put over the stomach, and smaller pads, to prevent pressure, should be placed over the anterior-superior spines, the sacro-iliac joints, the trochanters, the femoral condyles, and the malleoli.

The Cotton method simply adds to this the impaction of the lower fragment in proper position into the upper.

It might be well to mention here that we have found the Thomas splint is ineffectual in this type of case, in so far as it is impossible to maintain proper abduction. As a rule, the patient slips over in bed and lines the pelvis up with the abducted leg, entirely vitiating the attempt at abduction. This difficulty can be overcome by using two Thomas splints, one on each leg, thus preventing pelvic tilting, or by the use of the Crile modification of the splint, consisting of the addition of a pelvic band which prevents pelvic movement. This method is utilized in Canada and Great Britain, but this splint is difficult of obtainment in this country. The Whitman method gives by far the best results, however, and as it is so simple of application, is probably the best method of treatment of this type of case.

##### *Fractures of the Greater Trochanter.*

These are best treated by abduction and flexion of the thigh. If the fragments are widely separated, open operation should be instituted and the fragments held in place by some form of bone fixation, the autogenous bone peg being most effective and scientific.

##### *Fractures of the Lesser Trochanter.*

These should be treated in sharp flexion with a mild degree of adduction; probably the best way of attaining this position is by having the patient sit up in bed. In this way the traction of the psoas muscle is released and the fragments allowed to approximate. No special form of splint is required.

#### FRACTURES OF THE SHAFT.

The treatment of this type of fracture can be summed up in the proper use of the Thomas splint. All other forms of fixation, open operation, plating or wiring, can be relegated into the discard heap of surgical procedure, for if properly employed, the Thomas splint brings almost invariably good results. However, certain definite points must always be borne in mind, else failure may ensue:



1. A large-ringed Thomas splint should be utilized.
2. The ring must be held firmly below the tuberosity of the ischium. If this is not done, pressure sores result, as well as tilting of the pelvis. Besides this, the ring is not held clear of the anus and rectal function is interfered with. To maintain the proper position of the ring, a suspension cord is run upward to a pulley on the Balkan frame, and passes backward through a second pulley to behind the head of the bed. To it are attached weights (seven to ten pounds, as a rule, are adequate). Thus pull holds the ring snugly against the ischial tuberosity, even when the patient is moved or rises in bed.
3. Whenever possible, a knee flexion splint should be employed. This consists of the lower half of the Thomas splint attached to the sides of the main splint by a hinged attachment allowing of movement up and down, and giving free extension and flexion at the knee. A suspension rope passes from the end of the splint upward to a series of pulleys. The proximal end of the rope is attached to the ring of the Thomas splint. The patient can then, by pulling on the suspension rope, move the knee up and down at will. The maintenance of this free mobility at the knee is of extreme importance, as one of the commonest permanent deformities ensuing from fracture of the femur is stiffness at this joint. It should always be guarded against by massage and free movement.
4. The foot should be maintained at right angles to the limb. This position can be obtained by gluing the lower half of the sock to the plantar surface of the foot, or by means of a broad adhesive strip similarly applied. From this a suspension rope is run to an overhead pulley, to which is attached a light weight (two to three pounds are adequate.) Never should the sock or the adhesive plaster be permitted to pull from the tendo achillis, as pressure sores are sure to result.
5. Suspension of the leg is effected by means of transverse straps of bandage or flannel, four inches wide, fastened securely to the sides of the Thomas splint by paper clips. The first strap, known as the "master strap," should be placed directly under the site of the fracture and should never be removed. It should be just tense enough to allow the soft parts to ride at a level with the side bars of the splint. The remaining suspension straps should be adjusted snugly to the limb. If properly applied, as a rule, backward bowing of the femur is prevented.
6. Lateral bowing, or displacement of the fragments, is prevented by means of pressure pads at-

tached to the sides of the Thomas splint, made adjustable by set screws, which allow the application of the pressure wherever desired. The discs of these pressure pads should be made of wood, so as to allow the taking of x-ray pictures without their removal. In the case of marked anterior or posterior bowing, similar pads can be adjusted to the Thomas splint by means of metal arches attached to the side bars of the splint, to which the pressure discs are fastened, and pressure from either the front or behind thus obtained.

7. Traction. This is of two types, either skeletal or indirect. By skeletal traction is meant traction directly from the displaced distal fragment of bone. Numerous methods have been advocated, but all resolve themselves into modifications of the Steinmann nail traction or the ice-tong or caliper traction. Best results are probably obtained by some form of the ice-tong variety of traction. Certain specific precautions should be observed with this form of treatment.

(a) Strict asepsis must be observed.

(b) The synovial membranes and sacks about the knee must be avoided.

(c) The thinner parts of the condyle of the femur must be avoided by fixing the points of the caliper at the denser part of the bone at the level of the adductor tubercle.

(d) The tongs should be provided with guards to prevent their penetration of the bone and the meeting of their points.

Indirect traction is the type obtained by the application of adhesive bands or by means of cloth strips fastened to the leg with some form of glue,—Sinclair's, Heussner's, or the one preferred by the British, consisting of five per cent. celluloid dissolved in commercial acetone (the latter can be readily prepared from old x-ray films from which the emulsion has been removed.) Its sole objection is that it frequently causes localized blisters at the point of attachment of the traction strips.

These strips should always be applied well above the site of fracture to relax the entire muscle bundle about the fracture. Never should traction be made below the knee-joint, for, in our experience, this has invariably produced troublesome relaxations of the ligaments about the knee and localized the stiffness.

Whenever traction is applied, it should be maximum at the beginning and it should be continuous. The day after application a roentgenogram should be made to show the position of the fractured ends, and, if found in proper alignment, some of the weights



may be removed. A great many workers, however, prefer to have an excess pull so that when the traction is removed and the patient allowed to walk, shortening may not be produced by the retraction that usually occurs in soft callus. As a rule, I believe it is a good point to remember, although "caliper walking" should also obviate this difficulty.

#### FRACTURES OF THE LOWER THIRD OF THE FEMUR.

In this condition it is essential to place the ice-tong higher up than usual, because the lower fragment is carried backward into the popliteal space by the gastrocnemius muscle. With supracondylar fractures the limb should be put up in flexion in order to obtain neutral muscle pull. This allows free movement at the knee and prevents stiffness of this important joint. These conditions, essential for treatment, can be best obtained by means of a large-ringed Thomas splint elevated at its lower end and secured at the foot of the bed, while caliper traction is made from the condyles. The lower end of the bed can be elevated about twelve inches, after the Hodgkin's method. Should there be any tendency to lateral rotation, it can be effectually controlled by the Sinclair skid.

#### FRACTURES THROUGH THE CONDYLES.

Poor results are obtained by skeletal traction in these cases, for, in our experience, there is a tendency for the tongs to separate the fragments. The best method of treatment we have found to be the attachment of adhesive or gauze strips glued to the limb in a V-shaped manner, the apex upward and anterior, bringing the strips laterally over the condyles, the knee being kept in flexion and exerting traction from below. This forces the fragments together and maintains a proper pull downward.

If by this method reduction is not complete in one week, open operation should be instituted to properly approximate the fragments. This is especially true whenever the fracture line extends through the articular cartilages. Should the knee-joint be opened during this procedure, we have found that the split petalla approach offers the best results.

#### AFTER-TREATMENT.

This consists of careful observation and adjustments guided by *x-ray* examination. Massage and electric treatment of the muscles should be instituted on the first day and carried on to the complete rehabilitation to normal. The master band should never be removed. This form of treatment should be continued until bony union has occurred and should be judged chiefly by roentgenograms, although it is well to remember that it is not safe to bear any weight upon the limb until localized tenderness has

disappeared in the callus at the point of fracture. Backward bowing at the site of fracture should be carefully guarded against at all times, as this displacement, throwing the muscles out of the normal plane of action, causes serious after-derangement of the knee-joint. The ring of the Thomas splint should be observed daily and no over-riding of the tuberosity of the ischium should be permitted.

#### COMPLICATIONS.

With the advent of the Whitman method and the proper use of the Thomas splint, complications are few. At the point of entrance of the caliper there may develop a low grade osteitis. As a rule, however, this takes care of itself when traction is discontinued. Nerve injuries, although occurring in twelve to twenty per cent. of all cases during the war, are rare in industrial cases. They should, however, be watched for at all times and treated adequately. The same point applies to injuries to bloodvessels, especially of the popliteal artery.

#### CALIPER WALKING.

The fracture having united, the patient should not be permitted to bear his weight upon the limb until bony union is firm,—otherwise, bowing ensues with shortening, and the results of weeks of careful attention are destroyed. The caliper walking splint allows the patient freedom of movement commensurate with his condition, and will be found a valuable and necessary adjunct to the treatment.

#### SUMMARY.

I have attempted to outline here the essential points of treatment of fractures of the femur. Many smaller details have been omitted because I feel that each worker will find that certain smaller changes will, if necessary, give him results in individual cases, but there are certain basic facts which I would reiterate in conclusion:

1. Fracture of the femur is a serious process, both in its immediate aspect and in its possibility of permanent impairment of function.
2. The Whitman and Thomas splint methods bring almost perfect results if properly applied. The medical profession was slow to take them up but the great war and later experiences in industrial surgery proved their efficacy.
3. Every case should be painstakingly watched. Daily inspection and frequent *x-ray* examinations are as essential as the proper application of the method chosen for treatment.
4. The mobility of the knee should be carefully guarded by free, passive, and active movements and by massage.



I have purposely not entered into the discussion of compound fractures of this bone, because the essentials of treatment are the same as in uncomplicated cases, save for the proper management of the soft parts and any ensuing infection.

234 CONSOLIDATED REALTY BLDG.

### ARTIFICIAL TOES.

CHARLES CROSS, M.D.,

(Formerly M.C., U. S. Army.)

SAN FRANCISCO, CAL.

Those who have been crippled in the recent World War, or before, by the amputation or loss of one or more toes, or metatarsals, and who have suffered the great disability occasioned by the sacrifice of such a small part of their anatomy, will appreciate the appropriateness of considering at this time the subject of artificial toes.



Fig. 1. Foot injured in railroad accident, resulting in loss of great toe and first toe. See figures 4 and 6.

It was while in army service and teaching scientific examination of feet and non-surgical orthopedics for the treatment of ailing feet, rebuilding broken arches, and preventing foot ailments, that I had abundant opportunity to observe the great distress and reduced efficiency occasioned by the loss of even one toe.

So little attention has been paid to the feet generally by the profession that it appears the absence of a part of a foot has not been considered a matter of much moment. Most of the attempts to remedy the condition have been more inconvenient and painful than beneficial. Up to this time the efforts that have been made to devise some method whereby the normal mechanics and physics of walking could be restored to those who have lost some of the anterior portion of the foot, have not been very successful.

The Sunday newspapers recently announced in page articles that one of Ziegfeld's stars had a toe amputated. Let us hope her loss will not detract from her beauty. As ailing feet register their pain lines in the face, and the amputation of even one toe weakens the anterior metatarsal arch, this stage beauty is liable to suffer the same as other and plainer mortals.

### RESTORE NORMAL WALK.

This paper is to report results with what may be called "artificial toes" or "substitute toes", because mechanically, anatomically, and instrumentally, they take the place of missing toes. The device here described first came to my notice in an article by Ryberg. It gives so much comfort, and such perfect toe-service, permitting the wearer to do approximately everything that could be done before the loss of any part of the foot, that the term "artificial toes" appears quite appropriate. In addition to the



Fig. 2. Foot injured by a heavy weight falling upon it, resulting in loss of the heads of the second and third metatarsals and amputation of fourth toe.

almost normal toe-service, it also gives springiness to the gait by restoring ability to thrust the body forward and walk without limping. It enables the wearers to run, jump, dance, play tennis and, by freeing them from pain, removes the haggard lines that painful feet always cause to be registered in the face.

### EASE AND COMFORT.

The artificial toe is incorporated into the shoe and the wearer is not troubled with putting it on, or taking it off, any more than with putting on or taking off a shoe. Its presence cannot be noticed, and it causes no discomfort, nor is there any liability of chafing the foot. When properly adjusted, the injured parts are so protected and supported that the wearers feel the greatest comfort and benefit from the appliance as soon as they begin to wear it.



## POST-SURGICAL TREATMENT.

The cases here illustrated came under my observation within a few weeks of one another, and others have followed. Two were industrial accident cases and one was the result of the operation recommended by Morton for what is familiarly known as Morton's painful toe. For each of these patients the



Fig. 3. Amputation of fourth toe and metatarsal head for Morton's toe, followed by chronic pain across the foot because of weakened arches. Under proper treatment, these conditions can be permanently relieved without operation.

surgeons did all that operative surgery could do. But there still remained severe suffering, and a great degree of reduced efficiency. These patients are, therefore, able to speak from experience of the great relief they have gained from the use of the artificial toes and the treatment given to produce



Fig. 4. Roentgenogram of foot shown in figures 1 and 6.

relief and increased efficiency. Their words of commendation have encouraged me to submit this article for publication in the hope that the same benefits may be applied to others similarly afflicted.

## AVOID METAL ARCH SUPPORTS.

Attempts at relief by the use of metal arch supports had been made on all patients referred to me, but were unsuccessful. In fact my belief is that they did positive harm and such treatment is always

a distinct detriment. The use of any rigid or metal splint material is always sooner or later debilitating to other parts of the body, and experience leads me to believe that the feet are no exception to that rule.

## PREPARATORY TREATMENT.

On account of inflammation, atrophy, swelling and tenderness which may occur in an injured foot, the use of metal plates, and the habit of favoring the painful area, some preparatory and antiphlogistic rebuilding or adjusting treatment is always required before fitting the artificial toes. To get the best results, this treatment may run into months. During this preliminary treatment several examinations and surveys should be made to accurately determine the exact location of the axis of the weight-bearing area of the injured foot. This information is secured by studying the surveys and outline tracings which are made around the photo-pedo-graphs of both feet. From tracings properly surveyed and measured,



Fig. 5. Roentgenogram of figure 2. See figure 7.

the weight-bearing axis is determined and the exact dimension and shape of the artificial toe can be ascertained and the location it is to occupy in the shoe is indicated.

## LOCATING THE WEIGHT-BEARING AXIS.

After ascertaining the location of the weight-bearing axis on the photo-pedo-graph, the outline tracing is cut out and attached along the bottom of the patient's shoe, into which the artificial toe is to be placed. The site of the weight-bearing axis is indicated and marks the location the artificial toe is to occupy in the shoe. This area is then indicated on the bottom of the shoe, and the work is turned over to a skilled shoemaker, who has been instructed how it should be completed.

The outline tracing and the photo-pedo-graph of both feet are made at the same time. The photo-pedo-graph is a reproduction of the impression of that portion of the planter surface of the feet bear-



ing the body weight. It can be made by any method similar to those used to take finger prints.

The plaster-cast method of ascertaining the placement of the artificial toe is to make an impression of the plantar surface of the foot with body weight equally distributed to both feet. This impression can be used as a mould in which to construct a paraffin- or plaster-cast of the injured foot. The exact location of the weight-bearing surfaces are then indicated on the cast, and an estimate of the dimension, shape and location of the artificial toe is made.

#### ARTIFICIAL TOES.

As the normal foot action has a springiness, the



Fig. 6. Roentgenogram showing artificial toes in place. See photograph and roentgenogram of the same foot, figures 1 and 4.

artificial toe construction is for the same purpose. With specially processed spring steel, the artificial toes are made and so fitted along the weight-bearing axis of the injured foot, as to enable it to functionate as nearly as possible like a normal foot. According to the foot survey, as worked out and applied by the writer, the weight-bearing axis can be



Fig. 7. Roentgenogram of the foot shown in figures 2 and 5, showing artificial toes in situ.

located on an injured foot the same as on a normal foot. A proper distribution of the weight to be supported is the key to success in artificial toe construction, and may be likened to the weight distribution of an ice skater along the steel runner of the skates.

The most serviceable shoes for patients who require artificial toes are those made on the Munson army last. However, experiments are being made with other types of shoes for both men and women.

#### SUMMARY.

1. Proper size and correct placement of artificial

toes under feet from which toes have been amputated may restore normal walk and springiness to step.

2. By relief of the constant strain on injured tissues and destroyed arches, patients are given ease and comfort and their efficiency is greatly increased.

3. Much post-operative suffering can be relieved by artificial toes.

4. As a means of differential diagnosis following bunion operations, the use of artificial toes will decide whether weakness in a foot is the result of the operation, or due to injured arches.

5. Because of their rigidity, metal arch supports should not be permanently used under injured or ailing feet. When held rigid by metal splints, atrophy occurs quickly in foot muscles and adds to the disability, because the internal longitudinal arch was never intended as a weight-bearing area.

6. The weight-bearing axis for the successful



Fig. 8. Photograph of the "skate line" which shows the normal weight-bearing area of a foot, taken from below with the patient standing on a glass support.

placement of artificial toes is the same as if the weight were distributed along the narrow blade of ice skates.

7. All ailments and distortions of the feet require more treatment than is generally accorded them, and it is necessary that the treatment be given, and over a long period of time, to bring about the best results.

#### FLAT FEET.

The term flat foot is a relative one so far as function is concerned. The foot should be judged by what it can do, rather than by the height of the longitudinal arch. An important phase of the work of orthopedic surgeons in the army was to determine the ability of the foot of an individual to bear strain.—W. L. POWELL in the *Virginia Medical Monthly*.



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

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### ORTHOPEDIC SURGERY.

Garrison's History of Medicine tells us that it was Nicholas André who, in his treatise of 1741, "coined the term *orthopedics*". *Orthopedics* and *orthopedic surgery* are generally defined as "the art of treating deformities" or, as Bradford and Lovett would rather have it, "the prevention as well as the cure of deformity". As indicating the scope of the work of those who call themselves orthopedists, the definition is a poor one, since there are many deformities, e. g., congenital malformations of the genito-urinary organs, congenital and acquired deformities of the mouth and face, with which they do not concern themselves. *Per contra*, orthopedics has not limited itself to deformities, since it includes tuberculosis of the spine and joints, which produces "deformities" only as an end-result, and is no more "deforming" than other infectious and destructive processes heretofore usually surrendered by the orthopedic to the general surgeon.

Until very recently orthopedists were occupied in the treatment of a quite limited number of diseases—torticollis, static and nutritional deformities of the spine and extremities (scoliosis, bowlegs, knock-knees, flat-foot), congenital dislocation of the hips, congenital and acquired talipes, tuberculosis of the spine, hip and other joints, the management (by

supports, later by tendon transplantations, etc.,) of paralytic deformities. To be sure, some of the elder orthopedists—Sayre, for example—included fractures and dislocations in their work, but such injuries were, and still are, treated more often by the general surgeon.

Until quite recently also, orthopedic therapy was largely conservative, and depended to a very great extent upon the employment of supports, braces and plaster casts.

In both respects, orthopedic surgery is undergoing, indeed, has undergone, a change. The newer generation of orthopedists reaches out beyond this limited list of diseases and is deeply interested in the study and treatment of *all* the affections of the bones, joints, muscles, tendons—congenital, traumatic, inflammatory, neoplastic, paralytic; and it applies to them radical reparative, reconstructive surgery, as well as the preventive and supportive measures of hygiene, exercises and braces. Albee's "Orthopedic and Reconstructive Surgery" is quite representative of this widened scope and newer spirit in orthopedics. Other works, coming out of the war, e. g., Jones' "Orthopedic Surgery of Injuries" and "Chirurgie Réparatrice et Orthopedique", are also suggestive of the growth of this specialty. Indeed, the war itself, in which the general surgeon and the orthopedist were equally occupied in the management of the same casualties, stimulated, though it can not be said to have started, this expansion.

The definition of orthopedic surgery should be changed from "the treatment of deformities" to THE TREATMENT OF AFFECTIONS OF THE SKELETAL STRUCTURES. It is a large sphere, in which there ought to be ample room in civilian practice, as there was in the war, for both the general surgeon and the specialist. It is, too, a most inviting field, replete with interesting problems, pathologic, physiologic and mechanic.

We have planned this issue of the JOURNAL as expressive of orthopedic surgery in its broadened aspect; and we present it to our readers, not merely as interesting in its individual contributions, but also as a stimulant to those specialists who may not yet have caught the spirit of expansion.

We regret that an article on Tendon Transplantation in Cases of Musculo-Spiral Injuries Not Amenable to Suture, contributed for this issue by Sir Robert Jones, was received too late to be included. It will appear in a forthcoming number of the JOURNAL.



## SURGICAL FEES.

Much discussion has appeared in the lay and medical press concerning a recent pronouncement of the trustees of the Johns Hopkins Hospital that surgeons should not (which was a scarcely more pleasant way of saying they *may not*) charge more than one thousand dollars for any operation performed in the hospital, nor more than thirty-five dollars per week for attendance upon any patient therein.

Like most "restrictive legislation"—such as that against alcohol and, in some states, against tobacco—this is probably a reaction to abuses; and it seems safe to assume that on one more occasion there has been charged for an operation performed in the hospital a fee that was, or was thought to be, unreasonable in the circumstances. But if there were abuses, surely they could be corrected without such a sweeping and unreasonable ruling. Whatever its immediate and local purpose, the ruling can be interpreted only as an attempt to establish generally a maximum surgical fee; for it is inevitable that this ruling will be quoted in any court of law in which a surgeon may attempt to collect a disputed, larger fee.

Nor is the decree for the protection of those of moderate means; indeed, for them it will work quite otherwise. It is in the interest of the man of wealth. To him it says: "Though you pay \$5000 to the artist of the brush who reproduces your features upon canvas, \$1000 is quite enough to pay the artist of the scalpel who with delicate skill changes your living features to your liking, or to him who rids you of a tumor in your brain". We wonder whether any lawyers or engineers who may be trustees of the Johns Hopkins Hospital also considered the establishment of a maximum fee for them to charge in all cases, irrespective of the importance or the skill of their work, the responsibility and effort involved, the wealth of the client!

For the ordinary operations of surgery, under ordinary conditions, fees of more than one thousand dollars are quite exceptional and may well be regarded, in most cases, as excessive. But it should not be intimidated by the trustees of any hospital in this country that a charge of more than one thousand dollars for *any* operation upon *any* individual is excessive. No man who can not afford to pay a large fee is denied needed surgical attention; no patient who can not afford to pay any fee whatsoever is denied skilled surgical treatment; and no one, rich or otherwise, need put himself in the way of being charged more than he thinks reasonable and adequate, since it is simple enough to agree up-

on the remuneration in advance!

It was said, in the discussion of the Johns Hopkins pronouncement, that the practitioner of medicine should be content with a modest income, should not seek large remuneration for his services. Who knows better than the doctor himself that his life is sacrificial—of ease, of leisure, of pleasures, of peace of mind, of adequate financial returns! But shall the surgeon—or the physician—who has attained unusual skill and eminence be told, therefore, that it is a sort of disgrace for him to seek a large financial reward for his services, no matter what they were, from those who can well afford to pay it?

It seems likely that, if the surgeons at Johns Hopkins or elsewhere, who, by their reputation, attract patients of large means, accept this restriction upon their fees, they will make up for their losses by making larger charges to patients of moderate means and by seeking more of them—in competition with their younger and less eminent colleagues.

But the question of more-than-\$1000 fees will irritate the surgical profession at large more in principle than in practice. In the overwhelming majority of cases, after the patient has paid his hospital bills—*strictly in advance*, if you please—he is usually not able to pay his surgeon anything like a thousand dollars. Let us turn, then, to a consideration of the restriction of the surgeon's charge for hospital visits to \$35 per week. Assume the case of a man, with a fracture of the femur, occupying a room at \$10 per day. His surgeon does not operate upon him, but he spends many hours in adjusting and readjusting the suspension-traction apparatus, in *x-ray* examinations and in all the other minutiae of supervision and treatment that such a case always requires. At the end of eight weeks in the hospital this patient *will have paid* to the hospital, for his board and lodging and the board of two nurses, \$672, to each of these two nurses \$336 (a total of \$1,344—perhaps more), and he *will owe* to the surgeon who has borne the brunt of the work and *all* of the responsibility the princely reward of \$280! Can the Johns Hopkins trustees seriously mean that for all post-operative visits, no matter how many may be needed or how time-consuming they may be, the surgeon should charge not more than five dollars per day, that if his patient is sick enough to require his constant attendance the surgeon should charge less than he pays his chauffeur (if he is disgracefully prosperous enough to employ one)? Surely not. Probably all that is expected is a mere letter of explanation for consideration by an indulgent board of laymen!



The preparation for a medical career is becoming more and more difficult, more and more costly in years and in money. The practice of medicine is every year being harrassed with more and more regulations, restrictions, licensures—conceived for the most part in the public interest, but often with little regard for the physician.\* Some of our legislatures have dragged the practice of medicine, in the eyes of the public, down to the level of osteopathy, chiropraxis and perhaps other “cults” that are based on unproved and unproveable dogmata—the very thing from which medicine struggled in centuries gone by. And now the trustees of one of America’s leading hospitals have undertaken to regulate the physicians’ fees—not in the interest of the medical men who give of their time and their skill to the institution, but, forsooth, with a considerate eye to the pocketbooks of its wealthy patients. It all reminds us of an apt, but unprintable, remark, probably familiar, that is said to have been made by an attorney concerning his client, a large corporation that was perpetually pestered, restricted, taxed by every governmental agency that could find an excuse for hampering it. It reminds us, too, of a once familiar song. If the practice of medicine is to have the dignity that the welfare of the public requires for it, then,—to slightly paraphrase the title of that song—“you’d better quit kicking your dog around”!

\*Witness, for example, the absurd and cumbrous regulations for the prescription of habit-forming drugs, established by the sometime N. Y. State Commissioner of Narcotic Drug Control.

## Surgical Suggestions

In all cases of talipes, congenital or acquired, examine, by palpation and roentgenographically, for an occult spina bifida.

There are two inflammatory bone conditions that should be thought of as possible causes of persistent pain in an extremity not otherwise explained—syphilitic periostitis and chronic bone abscess. Both are tender on pressure.

Chronic, sterile, central bone abscess, large or small, can be cured by simple evacuation through a small drill hole. Introduce no instrument or drain into the cavity. A small drain may be placed in the muscles. The operation can be performed under nitrous oxid.

## Progress in Surgery

Selections from Recent Literature

H. Lyons Hunt, M.D., L.R.C.S. (Edin.),  
Abstract Editor.

**Rib Pressure and the Brachial Plexus.** EDWIN BRAMWELL and HAROLD B. DYKES. *Edinburgh Medical Journal*, August, 1921.

In this very interesting article Bramwell and Dykes show that: the same symptoms as may be produced by a cervical rib may also be caused by the pressure of an abnormal or *even by an apparently normal first dorsal rib*, and can be cured or relieved by removal of part of the rib; that cervical ribs often exist without symptoms; that those giving symptoms are usually in females; that the numbness and tingling of the fingers, especially the fourth and fifth, commonly complained of by women and often regarded as circulatory in origin, may be traceable in many cases to rib pressure on the plexus.

The article should be read in full. We extract the following significant passages:

*Unilateral Pressure Symptoms: no Cervical Rib. Removal of First Dorsal Rib; Recovery.*—A typist, 24 years of age, had been troubled for seven years with pain along the inner side of the left forearm which had necessitated her giving up her occupation. Upon examination, some weakness of the left hand and slight flattening of the thenar eminence were observed. Tenderness was complained of on pressure in the region of the transverse process of the seventh cervical vertebra on the left side. No definite sensory loss was detected nor was any difference between the radial pulses noted. The x-ray examination showed no evidence of a rib anomaly, although the transverse processes of the seventh cervical vertebra on either side were somewhat prominent. Rib pressure was diagnosed and Sir Harold Stiles decided to remove a portion of the first rib, an operation which was followed by immediate disappearance of the pain and by gradual improvement in the motor weakness.

Stiles has carried out the same operation in several cases of rib pressure with most satisfactory results. We have personally observed several cases in which symptoms which we attributed to rib pressure were not associated with a demonstrable cervical rib. Proof that pressure symptoms may be caused by an apparently normal first dorsal rib is afforded by the fact that in certain cases which have been operated upon, removal of the rib has resulted in the disappearance of symptoms. Objection might be taken to this conclusion on the grounds that in these cases the pressure is actually produced by the ligament which sometimes passes from the apex of the cervical rib to the first rib to which it is attached. If this is so, removal of that portion of the first rib, which includes the attachment of this ligamentous process, might be expected to relieve pressure just as readily as division of the band itself. On the other hand, in more than one case which we have observed, neither did the x-rays show any abnormality of the transverse processes of the seventh cervical vertebra, nor was any evidence of such a band found on operation.

### FACTORS WHICH DETERMINE SYMPTOMS

Pressure symptoms are observed only in a small proportion of individuals with cervical ribs. Borchardt states that they occur in five to ten per cent. Consequently, while it must be admitted that variations in the formation of the brachial plexus may predispose to rib pressure, additional factors must be responsible for the determination of symptoms. In this relation sex is evidently of the first importance. Although there is no evidence, so far as we know, to show that cervical ribs are more frequent in women than in men, the greater frequency with which symptoms of rib pressure are observed in the female as compared with the male sex is striking. Thus twenty of our twenty-three patients were women, an experience similar to that of other observers. Thorburn, for instance, met with only two males in a series of 17 cases, while fourteen of Hinds Howell’s sixteen patients were



of the female sex. Hinds Howell suggests that the more thoracic type of respiration in the female may be a determining factor. Wingate Todd has shown that in females a pronounced dropping of the shoulder girdle takes place in early adult life, and his suggestion that this may afford an explanation of the unequal affection of the sexes is an attractive one.

Brachial plexus lesions due to rib pressure may be conveniently classed, from the point of view of diagnosis, into two groups, viz.:—(1) Cases in which symptoms referable to the first dorsal root or lower cord of the brachial plexus are evidently caused by rib pressure, and in which a cervical rib or a rudimentary first dorsal rib can be demonstrated, and (2) cases in which the same group of symptoms is unaccompanied by any evidence of a rib anomaly, the symptoms being due to pressure by a normal first dorsal rib.

Again, a variety of types may be distinguished:—(a) Cases characterised by sensory, motor, and it may be vasomotor symptoms; (b) Cases in which pain and other subjective sensory phenomena are alone complained of, there being no objective sensory or motor disturbance; (c) Cases characterized by muscular weakness and wasting, pain and other sensory phenomena being either absent or inconspicuous features; (d) Rare cases in which vasomotor disturbance is the striking morbid manifestation; (e) Cases in which acroparesthesia and pain in the hand and fingers are associated with and apparently produced by rib pressure (Farquhar Buzzard).

A diagnosis may be difficult in cases in which there is no pronounced atrophy or sensory loss. The occurrence of pains from time to time in one or it may be both upper extremities, particularly in a young woman, should always suggest the possibility of rib pressure. When on further inquiry it is ascertained that the pain is confined to the forearm and that it is accompanied by other subjective symptoms, such as coldness in the hand, numbness or tingling in the finger-tips, and "pins and needles," referred especially to the little and ring fingers, possibly too by a feeling of weakness or clumsiness in the hand, the strong probabilities are that the symptoms are attributable to this cause. Corroborative evidence in support of the diagnosis is afforded when a history is obtained to the effect that the pain is relieved by raising the arm above the head, when there is localized tenderness in the neck, and when there is a difference between the radial pulses on the two sides. In a certain proportion of cases, the demonstration of a cervical or rudimentary first dorsal rib by the x-rays affords practically conclusive proof as to the nature of the condition. *It is to be remembered, however, that a diagnosis can and must in many cases be arrived at from the character of the pressure symptoms, for corroborative evidence is by no means always afforded by the x-ray examination.*

Cases of rib pressure in which the symptoms are not pronounced may sometimes be materially benefited by attention to the general health, and do not call for surgical treatment. When pain occurring from time to time is alone complained of, this symptom can usually be relieved by a sling which supports the elbow, while a blister above the clavicle may be helpful. Stopford lays stress upon the development of the trapezius muscle by exercise and faradic stimulation, with the object of counteracting the dropping of the shoulder-girdle. When pain due to rib pressure is so severe as to cause constant annoyance, or when pain or muscular weakness, or both, are producing such inconvenience as to interfere with the patient's occupation, surgical intervention is indicated.

The results of operative treatment in those cases in which pain is the prominent symptom are most satisfactory, for the pain is usually completely relieved. Thus, of 15 cases reported by Thorburn, in all of which pain was present, this symptom was completely cured in 12 and relieved in 3. Again, Sargent, whose experience has probably been unique in this department of surgery, reports that in all of the 5 cases he had met with in which there was bilateral pain, the patient returned to him at a later date and asked to have the opposite side operated upon. Paralysis, which was present in 12 of Thorburn's 20 cases,

was completely cured in 5 and greatly relieved in 5, while 2 cases were not traced. When there is pronounced wasting of the hand muscles, complete recovery cannot be expected. Ill-effects occasionally result from surgical intervention. Thus the pleura may be opened, while the supra-scapular nerve or the nerve to the serratus magnus or trapezius may be injured. Again, if the superficial branches of the third and fourth cervical nerves are divided, the patient may, for long afterwards, suffer from intense pain in the region of and below the clavicle. Further, the brachial plexus may be injured in the course of the operation as in two cases referred to by Sargent, in both of which there was complete paralysis of the upper limb, which was probably due to bruising of the plexus. In neither case was recovery complete six months after the operation.

#### Discussion on Bone Surgery in the Section of Surgery, British Medical Association, July 21, 1921.

Summary of Proceedings, from the *British Medical Journal*, August 6, 1921.

Naughton Dunn discussing *Compound Fractures* of the lower extremity attempted to lay down definite lines on which compound fractures and their complications should be treated in civil life. Emergency treatment included immediate application of a sterile dressing, a tourniquet, if necessary, and a Thomas splint suspended at its end for comfort in transport. It was a safe rule to operate on these cases early. The object was to remove all severely damaged tissue, muscle and skin and detached fragments of bone; to wash the wound thoroughly with an aseptic solution, then with spirit, and then to apply a film of bipp to all the wound surfaces; the wound was then to be sutured with drainage. Antitetanic serum was to be given as a routine in all cases of compound fracture. Alongside operation came treatment by splintage, and he believed that the Thomas splint met all the requirements for fractures below the upper third of the femur. He mentioned also the Jones abduction frame, Pearson's sectional bed for use with the Thomas splint, and the Sinclair net bed in the oblong wooden frame. At the end of ten or twelve weeks splints could be discarded and a caliper splint worn for weight bearing.

Dunn discussed also compound fractures involving joints, and their effect on the joints when not involved. In dealing with chronic sepsis following compound fractures he showed that, if operation were contemplated, it must be a radical one, and only to be carried out if the general health of the patient were good, if there were no signs of local reaction, absence of rise of temperature for three months, and a history of only slight reaction after previous operations. The operation consisted of excision of the sinus, long incision, free exposure of bone, removal of bone till all sequestra were exposed, and the cavity converted into a groove, spirit and bipp treatment as in the primary operation.

Subsequent speakers showed some diversity of opinion as to the value of the Thomas splint, the necessity for administration of antitetanic serum, the immediate and remote results of caliper extension. All were agreed that the compound fractures of civil surgery were in many respects different from those of war. Edington (Glasgow), Wade (Edinburgh), and Hamilton Russell (Melbourne) did not regard the extreme operative measures of the war as generally applicable to compound fractures of civil life. Fullerton (Belfast) recommended excision of the wound, avoidance of antiseptics, and extension of the caliper method.

Hamilton Russell in a short paper gave his views on theory and method in extension of the thigh. The muscles from the pelvis to the head of tibia and fibula prevented adjustment of the fracture, and it was of importance to overcome the resistance maintained by those muscles. This was best accomplished by a pulley arrangement whereby longitudinal extension of the leg was supplemented by vertical extension by a sling at the knee level, the resultant of these two forces being a pull on the lower fragment in the best possible line. He was by no means whole-heartedly in favour of the Thomas splint. It added to the weight of the limb, its extending force depended



upon pressure on a portion of the patient's body; that meant it was uncomfortable, and if it was not uncomfortable it was not efficient.

**Bone Grafts.**—Mr. Marcus Mamourian (Ashton-under-Lyne), propounded the theory that all that the graft did was to supply the biochemical stimulus or irritant which had been abolished by trauma or infection, the new bone being formed by the diaphyseal ends, by periosteal and bony remains in the shaft zone and in the young by epiphyseal lengthening, and he supported the theory of Murphy that the graft was ultimately absorbed. A large number of x-ray photographs were shown to support the thesis, which he put shortly in three points: (1) That the bone graft acted as a stimulant to the surrounding tissues; (2) that when the graft did succeed in persisting in the presence of infection, the success was not due to its own resisting power but to the fact that the infection was itself a stimulus; and (3) if there were no visible or palpable growth it was not evidence that there was no bone; it simply meant that the graft was dormant, its bone-forming properties inhibited by trauma or disease. It was important to note that a double action might be in process—bone formation at the proximal end and bone absorption at the distal end.

**Fracture of the Forearm in Children.** JACOB GROSSMAN, New York. *The Journal of Orthopedic Surgery*, May, 1921.

The author summarizes his article thus:

1. Where, for any length of time, infants and children refuse to use their forearms, after having sustained an injury, fracture should be suspected.

2. Colles' fracture occurs rarely in infants and children.

3. Fracture may be present, even though the cardinal signs of fracture are lacking. These fractures are usually of the subperiosteal variety. "Pencil" tenderness is the diagnostic sign.

4. Epiphyseal separation of the lower end of the radius should be looked for in all cases with injured forearm. It occurs often enough to be considered.

5. Plaster of Paris bandages are by far more efficient than splints and should be given the preference in the treatment of fractures.

6. Proper immobilization is as important as proper reduction in obtaining a successful issue in the treatment of fractures.

7. Shorter periods of immobilization, early massage and passive movements should be employed in children.

8. A pad between the shafts of the fractured bones, as recommended by many, for the purpose of preventing fusion of the fractures, is unnecessary as it could not separate the bone ends without exerting injurious pressure upon the circulation.

**The Non-Operative Treatment of Scoliosis.** WALTER TRUSLOW, Brooklyn, N. Y. *The Journal of Orthopedic Surgery*, May, 1921.

Truslow describes the methods of examination, mensuration and exercising, and concludes:

1. Successful treatment of structural scoliosis must depend upon a clear understanding of the elements of deformity, and the lessening, if not complete elimination, of all of them.

2. Uniform and regular measurement and numerical record of the elements of deformity are important as guides to continuance of treatment and as indicating elements most needing correction.

3. A balanced use of corrective plaster-of-Paris jackets, of retention brace and of intensive exercises is essential to satisfactory results.

4. The position of the patient when the plaster jacket is applied is responsible for improving body posture and shoulder carriage; the successive paddings, for care of the spinal deviation and the rotation.

5. Essentials of a retention brace are (a) ability to hold correction attained; (b) application by the patient with reasonable accuracy; (c) extensibility and lateral compressibility to meet normal growth and progressive deformity decrease; (d) mechanical self-correction by the brace seems possible, but not yet fully attained.

6. Gymnastic exercises must be progressive, intensive

and with a minimum of erect weight-bearing. They must aim to correct all of the elements of deformity, especially that of rotation. Starting positions other than standing facilitate these ends.

7. Retention of deformity correction attained must be maintained while exercise is developing natural muscular support. Artificial support may gradually give way to natural support. The paralytic scoliotic must receive a larger proportion of artificial support than will be required for those not paralyzed in the trunk muscles. Internal splinting, by operative bone-fixation, may also be necessary in severe paralytic cases.

**Some Aspects of the Mechanism of the Human Foot in Walking.** ALEXANDER GIBSON, Winnipeg, Canada. *The Journal of Orthopedic Surgery*, May, 1921.

After describing the mechanism of the foot in walking Gibson says, of heel-walking:

The heel is brought first of all to the ground with the foot in dorsiflexion, and from there the weight is transmitted to the outer spring of the foot almost entirely. The weight is thus mainly borne by the short hard spring. Next the weight is gradually transferred across the heads of the metatarsals to the inner side of the foot. A gradual roll of small amplitude accomplishes this. The under surface of the os calcis is curved, and the fibro-fatty tissue between the bone and the skin acts as a yielding cushion. The cuboid bone is wedge-shaped, the small side of the wedge facing outwards, and the result of pressure on the outer spring must be to press this bone inward to a slight extent, thus transmitting some of the shock of impact of foot on ground to every bone of the tarsus and metatarsus. At the completion of the second stage, the foot is balanced momentarily on the tripod consisting of the os calcis posteriorly, the heads of the fifth and first metatarsals anteriorly. From this point onward all the weight is taken on the inner spring. The head of the first metatarsal sustains all the weight of the body in the take-off for the next step. The long flexible inner spring acts for the succeeding step the role of a diving board. The line of transmission of weight is along the first metatarsal shaft to the base, then through the interosseous ligament to the base of the second metatarsal which is recessed between the first and third cuneiforms, then through the second cuneiform to the central part of the scaphoid, and through it to the astragalus and so to the bones of the leg. The middle cuneiform and the central part of the scaphoid are thus the key bones of the inner spring of the foot. The middle cuneiform is buttressed on either side by the first and the third cuneiform bone and the scaphoid is similarly buttressed by the strong inferior calcaneo-scapoid ligament below and by the external calcaneo-scapoid ligament on the outer side.

The use of a heel on the boot involves a sacrifice of stability. But since the ground we tread is for the most part smooth, and comparatively free from obstacles, a small sacrifice of this may be made with impunity. If it be admitted that the use of a heel to the boot economises expenditure of energy in locomotion, it will be seen that the use of a heel of moderate height is a measure of practical utility. More important than the height of the heel is its area. This should always be large. For practical purposes a heel not exceeding an inch or an inch and a half in height permits of active use of the calf muscles, does not excessively throw the weight forward, and yet takes off a considerable portion of the muscular strain of walking. One must bear in mind that in walking the minimum of muscular effort is made. If sufficient is called for to produce tiring of the muscles, the result will be that more and more weight will be thrown on the ligaments, the muscles themselves will be used as ligaments, and there will be consequent stretching with development of the symptoms of foot strain. This is well seen in the case of ballet dancers who are said to be for the most part flat footed. They have developed extreme flexibility of the joints of the foot, along with excessive muscular power. When necessary the arch of the foot can be formed in exaggerated degree, but when off guard as it were, they tend to use the muscles as ligaments, and the foot is correspondingly flat.



As a further corollary, it follows that the boots used should be long enough and wide enough to give free play to the intrinsic muscles of the foot, they should be in no respect splints for the foot, and active development of the foot muscles is likely to provide the best safeguard against the painful condition known as "footstrain."

### Reconstructive Surgery of Traumatic Foot and Ankle Deformities. ALBERTUS COTTON, Baltimore, Md. *The Journal of Orthopedic Surgery*, May, 1921.

Of the treatment of traumatic weak foot following imperfectly reduced Pott's fracture, Cotton says:

This deformity gives the typical symptoms of rigid weak foot—pain on changing from a resting to an active position, weakness, lameness and stiffness. While the symptoms of these deformities of the foot are practically the same as those of rigid weak foot due to spasm or actual contracture of the peroneal tendons, the treatment must be different. Tenotomy of the peroneal tendons with wrenching and breaking up adhesions on the outer border of the foot will not cure or relieve the symptoms of this condition. It is necessary to restore the alignment of the foot to the leg, to put the foot back in gear with the leg. The astragalus must be pushed inward so that a line from the tubercle of the tibia passing through its center will pass through the space between the second and third toes. This can be brought about either by osteotomy of the tibia and fibula above the old fracture or by re-fracturing the bones at the site of the old fracture. Simple osteotomy of the tibia and fibula above the old fracture is a simple operation and is quite effective in restoring function in the majority of cases. The cosmetic effect is not all that could be desired. Re-fracturing through the site of the old fracture of the internal malleolus of the tibia and fracture of the fibula has several advantages over osteotomy. It is a more direct attack upon the deformity at the seat of the trouble. At the same time that the bones are re-fractured the adhesions about the tibio-fibular joint can be broken up and the astragalus, together with the lower fragment of the fibula, pushed inward to its normal position. After obtaining this reduction it is frequently necessary to nail the internal malleolus of the tibia in place. It is usually not necessary to use any other mechanical aid to reduction except to hold the posterior portion of the foot adducted and at a right angle to the leg while the cast is being applied.

### Arthrodesis of the Sacroiliac Joint. A New Method of Approach. M. N. SMITH-PETERSON, Boston, Mass. *The Journal of Orthopedic Surgery*, August, 1921.

The steps of the operation are as follows:

1. Curved incision from the posterior superior spine along the crest of the ilium, two-thirds of the distance to the anterior superior spine. This incision is carried down to the bone and the reflection of the periosteum started.
2. Incision from the posterior superior spine in the direction of the fibers of the gluteus maximus for a distance of three to four inches. This incision is carried down through the subcutaneous fat and gluteal fascia and the muscle fibers of the gluteus maximus separated by blunt dissection, until the junction of the ilium and sacrum, between the posterior superior and posterior inferior spines is reached. In carrying out the dissection, one point should be kept in mind: the superior gluteal nerve and artery emerge at the anterior portion of the sacro-sciatic notch and give off posterior branches which are encountered by the straight limb of the incision, and sometimes cause considerable bleeding. They have to be sacrificed in order to get a satisfactory reflection.
3. The flap thus outlined is reflected subperiosteally, exposing the posterior portion of the lateral surface of the ilium.
4. If the sacro-iliac joint is projected on the lateral surface of the ilium, it will be found that the inferior border corresponds with the sacro-sciatic notch, and the anterior border with the median gluteal line. The superior border is not of importance, because the two above landmarks determine the location of the joint sufficiently. A

window is now cut through the ilium within the projected area of the joint. A rectangular window has been used in the majority of cases. The thickness of the ilium just above the sacro-sciatic notch is considerable, sometimes as much as an inch, but if care is taken, the entire block of bone from the outer to the inner table of the ilium may be removed in one piece. The operator is rewarded for his labor, when, upon removal of the window, the cartilaginous joint surface of the sacrum comes into view. The cartilage of the sacrum as well as its cortex is next removed, bringing about a good exposure of cancellous bone. The above procedure results in a rectangular channel bordered on all sides by cancellous bone, extending from the ilium through the sacro-iliac joint into the sacrum.

5. After removing the cartilage and cortex from the block of bone removed from the ilium, this is replaced in its original site and countersunk, so that its cancellous surface will be in contact with the cancellous bone of the sacrum.

6. The flap is now returned to its place and periosteum and soft parts sutured in layers.

The position of the window should be varied according to the case encountered. In purulent infections of the joint, the window is cut in a direction parallel to the sacro-sciatic notch; this will give efficient drainage of the joint. In cases of tuberculosis, it is better to cut the window at an angle as a better dowel is thus obtained. This, of course, also holds true in cases of sacro-iliac relaxation.

In cases of tuberculosis, the above description does not hold absolutely true, as the curette has to be used extensively to reach the parts of the joint not actually exposed. Seven cases of tuberculosis of the sacro-iliac joint have had arthrodesis of the above type during the past three years, with uniformly gratifying results. Cases of relaxation of the sacro-iliac joint which have had the above type of arthrodesis performed, have also been uniformly successful. They are, however, only six in number, three of them too recent to judge.

### Manipulation of Stiff Joints. SIR ROBERT JONES, Liverpool, Eng. *The Journal of Orthopedic Surgery*, August, 1921.

A painful joint which is rigid in all directions is the seat of an arthritis, while a painful joint which is rigid in certain directions only—movements being normal in others—is free from arthritis. This is more obvious in joints such as the wrist, shoulder, hip and spine, which have a comprehensive range of movement, than in joints such as the elbow, ankle and knee, where the movements are practically limited to flexion and extension.

If there be no limitation of movement in a suspected joint, there is no arthritis. In early cases the rigidity must be examined for without an anæsthetic, as it is primarily due to protective muscular fixation. Later, contractures or muscle shortening will follow as secondary effects, but by then a diagnosis will be obvious. One illustration will suffice to make this clear. A girl complains of pain in the dorsolumbar region of her spine. The surgeon asks her to flex, extend, rotate and laterally move her spine. If she can do so she has neither adhesions nor arthritis. Another may have great tenderness over her spine, and is unable to fully flex or laterally deviate her spine, but she can hyperextend. This case can be assumed free from arthritis and may probably have adhesions. A third case is rigid in every direction, and her condition may be diagnosed as an arthritis.

This classification requires modification when we deal with fractures into joints with bony blocks, or with myositis ossificans in the muscles surrounding a joint.

Adhesions may be divided into two groups—(a) intra-articular; (b) extra-articular.

Intra-articular adhesions may be the result of rupture of joint capsule, of hemorrhage, or of the plication, with adhesion, of the synovial membrane. Rupture of the intra-articular ligaments, such as the crucial and ligamentum teres, do not give rise to adhesions which require surgical attention.

Extra-articular adhesions may be connected with the capsule, the ligaments, muscular origins or insertions, rup-



ture of the muscular fibres or blood extravasation into tendon sheaths. Stiffness of the joint may also be the result of adaptive muscular shortening, physiological in character, or it may be due to loss of resilience in the sheaths surrounding muscle and muscle fibre.

Prolonged immobility of a healthy joint will result in temporary stiffness, which is usually due to adaptive shortening of soft structures, and this can be rectified without forcible manipulation.

Light adhesions may be broken down under gas, or gas and oxygen; if strong and resistant, full anaesthesia is best. Complete muscular relaxation is rarely obtained, under gas, and, in consequence, the surgeon is less able to gauge the force he should apply. The joints should be moved through the full anatomical range unless the adhesions are extremely firm. If firm and resisting, the movements should be less complete, and full mobility should be secured in stages. The advantage of the use of gas is that the movements may be voluntarily practised almost at once, and this is of considerable psychological advantage. After all adhesions have been overcome, and while the patient is asleep, the limb should be placed in the position of full correction until he recovers consciousness and is able to make a voluntary effort. This helps to emphasize the right of way, and furthermore, has a good mental effect, for the patient, when he becomes conscious, realizes that the obstruction has been overcome. The earlier movements are practised after manipulation the better, for the pain is less acute and the results more rapid and effective. If, however, the manipulation has been very severe and reaction is feared, it is advisable to fix the limb for a few days in the corrected position in order to rest the assaulted joint, massage being substituted for movement.

The normal range of movements in a joint varies in different people and at various ages. It is advisable, therefore, during our manipulation of any joint, to compare its range of movement with that of the opposite side. Unless this is done, it is easy to produce a sprain.

If, as a result of manipulation, the range of movement is diminished, it is fair to conclude that the after-treatment has been defective, or that the manipulation has been ill-advised. After the joint has been conducted through its complete range of movement once, it is useless and harmful to repeat the procedure. The "pump handle" method, as applied to the breaking of adhesions, or the practice of passive movements, is to be avoided. Voluntary efforts, however, can be repeated with advantage as often as the patient can be persuaded to make them.

Passive movements and the breaking of adhesions by manipulation in the presence of fracture near a joint, should be most carefully performed. The fracture should be adequately protected from strain by closely applied splints.

If effusion should take place in a joint after manipulation, it is strongly suggestive of the rupture of intra-articular adhesions. Such effusion does not necessarily imply that the manipulation should not have been employed unless the effusion is accompanied or followed by a diminished range of movement. If the range of movement is diminished by use and exercise, the joint requires rest. If, even in the presence of pain, the range of movement is increased by exercise, rest is contra-indicated.

The rupture of typical adhesions is heard and may be felt under the hand. If no click is heard or felt, but the resistance is overcome by a gradual stretching, the prognosis is not so good, and the joint should be retained at rest for a few days in its new and corrected position. Passive movements should then be gently practised. Pain which is sharp and of short duration is negligible, but if pain continues for protracted periods, it means a reaction likely to be followed by increased stiffness, and calls for rest.

#### Diagnostic and Therapeutic Point in Retrocalcaneal Bursitis. A. L. NIELSON, Harlan, Iowa. *Journal of the A. M. A.*, August 6, 1921.

This bursa is subject to the usual affections of bursae in general. Of special infections, tuberculosis occurs, and when it does occur, it extends to the bone quite readily,

owing to the thinness of the bursal wall in its anterior and upper aspects. Gonorrheal infection attacks this bursa, as do rheumatic infections. In chronic infections of the bursa, there is a thickening of the bursal endothelial lining. There may be cartilaginous hypertrophy and periostitis, with formation of exostoses. Effusion is rare. Direct infection by puncture wounds may occur.

The causation of disease of this bursa may be classified as: (1) functional, (2) traumatic and (3) bacterial. Overuse of the foot, too much walking, the trauma incident to pressure of shoes, usually too short shoes, are etiologic factors in most cases. Bacterial infection is chiefly metastatic, the disease being, on this account, very often bilateral.

Pain is localized at the junction of the Achilles tendon and the os calcis. This pain is only on motion; rest relieves, and there is more comfort with the foot everted and the leg rotated outward. There may be tenderness over the bursa, and often there is an appreciable swelling or a doughy mass on each side of the Achilles tendon. A diagnostic point, also valuable as a therapeutic measure, was suggested by J. B. Murphy. The pain is due to the pinching of the inflamed and enlarged bursa, between the Achilles tendon and the os calcis, on flexion of the ankle. If in any suspected case removal of this pressure relieves the pain, we may conclude that retrocalcaneal bursitis is the condition with which we are dealing. This is accomplished by putting the patient on high heels, mechanically increasing the distance between the tendon, just above its insertion, and the os calcis, thus giving more room to the bursa and preventing pinching between tendon and bone, as occurs in ordinary flexion of the ankle. Nielson had a three-fourths inch rubber heel added to the ordinary low leather heel.

Roentgen-ray findings are negative in the absence of exostoses. Treatment of this condition, aside from the foregoing method, is surgical removal of the bursa. The presence of long continued inflammation, cartilaginous bodies, or exostoses requires operation. Careful fitting of shoes is necessary to prevent pressure on the heel over the bursa. Local treatment is of little value. Robert Jones reports results with actual cauterization of the bursa, by inserting a heated needle into the bursa.

#### Autogenous Bone Transplantations. MELVIN S. HENDERSON, Rochester, Minn. *Journal of the A. M. A.*, July 16, 1921.

The cases studied comprised 413 patients subjected to the operation of transplantation of bone. One hundred and sixty-six of the patients were operated on according to the method of Albee for tuberculosis of the spine, and 247 were operated on for ununited fractures, bony defects, etc. One hundred and thirty-two patients with tuberculosis of the spine operated on more than eighteen months before have been definitely followed. Sixty-six (50 per cent.) may be regarded as cured or as having the disease arrested; twenty-nine (22 per cent.) were improved; twenty-two (16.66 per cent.) were unimproved; twelve (9 per cent.) died later, probably of disseminated tuberculosis; three (2.26 per cent.) died so soon after the operation that their deaths must be classed as operative mortalities. The operation is advised only in adults. Four (2 per cent.) developed infection in the wound in the spine; there were no infections in wounds in the leg. Two grafts were lost.

Two hundred and twenty-three of the 247 patients operated on for ununited fractures, etc., were traced. In 177 (79.3 per cent.) the operations were successful, and forty-two (18 per cent.) were failures. Four (1.7 per cent.) of the patients died. Two hundred and forty-one operations were necessary to obtain these successes; thus, the 73.4 per cent. successes are based on the number of operations rather than on the number of patients. In contrast to the spinal cases, which were better than the average in any group of clean cases, the percentage of infections ran high. Thirty-nine (15.7 per cent.) of the 247 patients developed infections. Two hundred and one had clean wounds. Many of them had been operated on before without suppuration, but often with considerable scarring; twenty (9.9 per cent.) of these became infected. Forty-six patients had been infected previously, although apparently the



wounds were clean at the time of operation, and in nineteen (41.3 per cent.) suppuration followed surgical interference. These infections caused the loss of the graft in fifteen cases (6 per cent.), and in almost all a persistence of the nonunion. The technic used in the spinal transplant was used in the fracture transplants. In the first group the percentage of infections is considerably below and in the second, above normal. I believe, therefore, that the cause of the infections rests on the type of case rather than the technic. Possibly a two stage operation would lower the percentage of infections.

The percentage of successes in operations on the various long bones was: tibia, 89.4; ulna, 81.2; radius, 78.4; humerus, 69.6; femur, 57.5. The massive graft with beef-bone screws to hold it in place has given better results than either the intramedullary or the inlay graft.

## Book Reviews

**On Bone Formation.** Its Relation to Tension and Pressure. By DR. MURK JANSEN, O.B.E., Lecturer on Orthopedic Surgery, University of Leiden (Holland). Octavo; 114 pages; 54 illustrations. Manchester: THE UNIVERSITY PRESS. London, New York, Bombay, etc.: LONGMANS, GREEN & Co., 1920.

This monograph, illustrated with excellent photographs of bone sections, is concerned, not with the problems of bone regeneration, but solely with bone architecture. The thesis is a contradiction of the dicta of Culmann, Meyer, Wolff and Roux that tension as well as pressure determine the lines of internal bone structure.

**Injuries to Joints.** By COL. SIR ROBERT JONES, C. B., CH.M., D.Sc., Inspector of Military Orthopedics, Army Medical Service. *Second Edition.* Duodecimo; 195 pages; 29 illustrations. London: HENRY FROWDE; HODDER & STOUGHTON, 1920.

This admirable little "Oxford War Primer" is, or ought to be, thoroughly familiar to the English-reading medical profession. The general surgeon, the orthopedist, the general practitioner who has not read it has missed something! It is a *multum in parvo*, indeed; almost every page is replete with valuable instruction. The changes in this edition consist in the interpellation of a new paragraph here and there, enlarging the primer by nine pages.

**Die Örtliche Betäubung. Ihre Wissenschaftlichen Grundlagen und Praktische Anwendung.** Ein Hand- und Lehrbuch von PROF. DR. HEINRICH BRAUN, Geh. Medizinalrat, Direktor des Krankentiftes in Zwickau. *VI Auflage.* Octavo; 508 seiten; 213 abbildungen. Leipzig: JOHANN AMBROSIOUS BARTH, 1921.

In the sixth edition of this very complete, precise and well illustrated work on regional (including local) anesthesia, spinal and sacral anesthesia are dealt with at length, novocain poisoning is described fully, and there is an appendix of forty solid pages of classified bibliographic references. The work is a painstakingly comprehensive one.

**A Text-Book of Pathology.** By ALFRED STENGEL, M. D., Sc. D., Professor of Medicine, University of Pennsylvania, and HERBERT FOX, M. D., Director of the Pepper Laboratory of Clinical Medicine, University of Pennsylvania. *Seventh Edition.* Octavo; 1111 pages; 509 illustrations, many in colors, and 15 colored plates. Philadelphia and London: W. B. SAUNDERS COMPANY, 1921.

The fact that this text-book has passed through seven editions and numerous reprintings in twenty-three years is evidence that it meets the desires of a large medical public. The book covers the entire field of general and special pathology and trenches also upon bacteriology and clinical pathology. To embrace all these subjects within the compass of 1111 pages requires extreme condensation, the sacrifice of much that is important, and the omission

of much that is worth while and broadening in the study of pathology.

The chapters dealing with animal parasites, diseases of the blood vessels and diseases of the blood are good. The chapter on the endocrine organs is brought well up to date. The description of nephritis, in which the authors attempt to combine a clinical and a pathological classification, is not clear. In all other chapters an ultra-conservative desire to exclude all controversial matter has resulted in the omission or slighting of many new facts. To give a few instances: in the description of syphilitic lesions no mention of the finding of spirochetes in the sections is made; the description of endometrial diseases barely touches upon the long-accepted functional changes formerly classed as "endometritis"; the "fibroid heart" is resuscitated from the old text-books of gynecology.

The illustrations are fairly numerous. The original text figures and colored plates are good. The more numerous pictures derived from other sources vary greatly, some being well chosen and adequate, others, such as figures 53, 401 and 429, have no place in a modern text-book, having earned oblivion by long and faithful services during many by-gone years.

**Diseases of the Intestines and Lower Alimentary Tract.** By ANTHONY BASSLER, M.D., Professor of Gastro-Enterology, Fordham University Medical College and New York Polyclinic Medical School and Hospital; Visiting Physician, New York Polyclinic Hospital; Visiting Gastro-Enterologist, Peoples Hospital; Consulting Gastro-Enterologist, Stuyvesant Polyclinic, Beth-David and Christ's (N. J.) Hospitals. Octavo; 636 pages; 154 text engravings and 62 full-page half-tone plates. Philadelphia: F. A. DAVIS COMPANY, 1920.

This is a well written volume, the logical sequel of the author's book on "Diseases of the Stomach." The volume deals with a subject which is difficult to handle, insofar as the classification of intestinal diseases has always been one of much dispute and difference of opinion. The method of presentation chosen by the author is a favorable one in that he treats many of these diseases as a growth and thus the subject is made intelligible and comprehensible to the reader.

When we consider the extreme paucity of books in the English language on diseases of the intestine the addition of this interesting volume should be appreciated. The chapters on Anatomy and Physiology are full and clearly described. The section on Pathological Physiology and Pathological Chemistry, an understanding of which is so essential to an appreciation of intestinal function, is thorough and replete with facts and shows a close acquaintanceship with the literature, particularly with much of the newer work. The chapters on Chronic Excessive Intestinal Toxemia follow closely the lines laid down in the previous work of this author. The different types of so-called intestinal intoxication are fully described from all aspects, particularly the bacteriological. The rigid pictures of the indolic and of the saccharo-butyric types seem overdrawn and it is very questionable whether the profession at large would accept the classification of clinical types as they are here described. It is still more doubtful whether the mass of the profession would subscribe to the vaccine therapy which the author here enthusiastically advises.

In dealing with the chapters on Lane kinks, Jackson membranes, ileal stases and ileo-cecal regurgitations the author expresses sound and well-balanced views, avoiding the extremes of those either too radical or too conservative. The surgical viewpoint of chronic appendicitis as a clinical entity as the "commonest abdominal affection" is accepted, a viewpoint which is being more and more questioned as time goes on. The chapters on Abdominal Diseases, including New Growths of the Intestines, is thorough. It is particularly commendable that the book is supplied with many radiographic pictures, the reproductions of which are clear and distinct and actually show what they are supposed to show.

All in all, the book deserves warm commendation as an interesting volume covering a complicated and poorly understood group of diseases.



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## CERTAIN POST-OPERATIVE COMPLICATIONS OF OPERATIONS ON THE THYROID GLAND.

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*Attachment of the Scar to the Trachea.* In certain rare instances the scar becomes attached to the trachea at the point of drainage. An objectionable consequence of this scar is its rise and fall during swallowing, coupled, in some instances, with a slight pulling sensation. The complaint of the patient, however, is nearly always directed against the appearance, rather than against the pulling sensation. After tracheotomy, the scar is sometimes attached closely to the line of healing of the opening in the trachea. In any case, such a scar is easily relieved by excision of the cicatricial down to the normal tissue, the separated fascia and muscle being approximated so that a normal superimposed tissue intervenes between the trachea and the skin. The skin is closed with skin clips. The operation is slight; the discomfort negligible; the result invariably good.

*Unevenness of the Neck after Thyroidectomy, due to permanent absorption or displacement of tissue made by the long continued pressure of the growth.* After the removal of a large deforming goiter which has left inequalities in the contour of the neck, the occasional patient develops an uncontrollable longing for the perfect neck of her girlhood days; rather the girlhood days of her friends, for her own neck was always full, uneven, deformed. After years of skillful shading, draping, and posing, as skillful as the revealing and concealing adaptations of animals in struggle and survival, it is not unnatural that in these patients the sensibilities are so heightened, and the hope for a perfect neck is so intense, that special consideration is demanded. In such a case after every attempt has failed to persuade the patient that she has already made a good bargain with fate we have reopened the neck, and have reflected back the skin rather widely so as to give an opportunity for sliding fascia or muscle and

transplanting fat from elevation to depression. In short, we have modeled a new neck which in its lines and depressions approximates as nearly as possible the neck of youth.

*Post-operative Hoarseness.* In the occasional case, hoarseness persists. This is usually overcome spontaneously and very rarely remains permanent. In our earlier series, hoarseness was much more common, and in every instance its cause could be traced. The most common cause was grasping or making traction on the nerves in the control of bleeding. The vessels in apposition with the recurrent nerves or the parathyroid would occasionally escape and retract, carrying their bleeding ends behind the position of the parathyroid, the blood meanwhile flowing freely, hiding the vessel. The securing of the bleeding end is aptly likened to catching a squid. No squid was ever more beclouded or more elusive than the bleeding superior or inferior thyroid artery. In the pursuit it is best to expose the spurting end and secure it alone.

Another cause of hoarseness was the rough tearing out of the goiter with the finger from the side and from behind or the use of the large Kocher barbed forceps which gathered in the tissue in the neighborhood. Still another cause was the complete exposure of the recurrent nerve during the operation, leaving it in contact with the process of healing and cicatrization of the wound.

*Aphonia.* Occasionally, a patient returns from the operating room, serene but voiceless; or after some days of clear voice, she becomes abruptly aphonic. With these psychic voice failures the surgeon gives himself no concern. In due course, the voice returns unheralded and as abruptly as it disappeared. As far as is known, in but two instances in thyroidectomies has there been permanent aphonia.

*Singing and Thyroidectomy.* A singer, with a gradually enlarging goiter, apparently is in a dilemma. If the goiter is left alone, there is the ever-present possibility that the voice will be affected; the strain on the vocal cords is increased. In any case the stage appearance is affected. On the other hand, there is the fear that the removal of the goiter will change the physical environment of the larynx



sufficiently to alter the quality of the voice, and the possibility of temporary huskiness or hoarseness after even the best planned operation, is increased in the case of a highly developed voice, and, of even more importance, in the case of a highly developed temperament. The surgeon's burden of responsibility is increased by the consciousness that if the artist later loses prestige from any cause, even including the inevitable effect of increasing years, the blame will probably be placed upon the operation. However, by the avoidance of each of the dangerous maneuvers described above we now seldom note any essential alteration in the voice, even immediately after the operation. In fact, it has been our experience that even the singing voice is often more improved than injured; a certain tendency to flatness is replaced by resonance; certainly the flat, speaking voice, so commonly resulting from the pressure of the massive goiters, is greatly improved. Taken as a whole, we believe that the average effect on the voice is an improvement.

*Intermittent Respiratory Block.* An inspiratory block occurring principally at night at irregular intervals is an occasional sequel. This is due to abductor paralysis as a result of which the vocal cords are floated out by the current of expired air but block the incoming current of air in somewhat the same manner as the aortic valves block the blood from returning to the heart, or as the gates of a lock block the flow of water. The effect of this distressing complication is due more to the sensation of suffocation and its resultant fear than to the actual want of air. Though asphyxia may occur, should the condition continue, the vocal cords may be clipped off in the center of their free margins leaving a free space for the exchange of air.

*False Alarms.* For some time after thyroidectomy, the patient's low thresholds lead to needless worries from mistaking an enlarged lymphatic gland for goiter; from mistaking pharyngitis or laryngitis for some feared "inward" trouble; from interpreting worry and sleeplessness, resulting from normal causes, as an "inward goiter". Any local pain, stiffness, pull, hoarseness, depression or inequality may cause uneasiness or apprehension. Usually a word of reassurance given, however, only after a careful reexamination, is sufficient.

*Post-Operative Infection.* Because of the large, loose, partially occupied space in the neck, following the removal of large thyroids; and in particular because of the facility for the pooling of wound secretion under the clavicle and because of the necessity

for drainage, infection is occasionally seen. We have found that on the first appearance of infection, it is best to open the neck widely and promptly and sterilize the entire field of operation by hot packs, and Dakin's fluid; and making an early secondary closure in accordance with the method which was so extensively and successfully practiced in the war. The point of prime importance is immediate and wide opening and exposure of the entire wound to treatment.

*The Prevention of Post-Operative Enlargement of the Remaining Thyroid Tissue after the removal of colloid goiters or of colloid adenomata.* After the removal of large, plain goiters, especially in obese women, the portion of the gland that is left open retains sufficient growth-energy to rebuild a goiter of large size within a few years. These patients are disappointed, and their confidence in reoperation is not easily established—nor should it be. Basing our practice on the easy control of endemic goiter by the administration of iodine, we now give iodine for not less than one year after thyroidectomy to all goiter patients excepting cases of exophthalmic goiter or of toxic adenomata. Thus far the redevelopment of plain goiters seems to have been effectively prevented by this measure.

*Thyroid Deficiency.* In perhaps 1 out of 500 cases, the thyroidectomy is followed by symptoms of thyroid deficiency. This complication is easily controlled, not by iodine, but by the intermittent administration of thyroid extract. In course of time, for some unknown reason, the symptoms of deficiency permanently disappear.

#### EXOPTHALMIC GOITER.

There has always been a very considerable proportion of the profession, with large experience, who have insisted that a real rest cure, not a half-and-half one, is of infinite value in many of these patients, the great difficulty being that those of limited means cannot resort to it, and its carrying out in a general hospital is almost impossible. It has also been admitted by most surgeons of experience that a period of rest in bed prior to operative interference is always desirable, and there is no question that the rest which is insisted upon by the surgeon after he operates is an important factor in the ultimate recovery of the patient. As a matter of fact we are rapidly coming to the view that the thyroid gland in exophthalmic goiter has to be treated in different ways, depending upon the individual peculiarities of the case rather than upon any standard proposition, because in no other disorder of function are the conditions of one patient so widely divergent from the conditions which may exist in another.—*The Therapeutic Gazette.*



## OPERATIVE TREATMENT OF ACUTE DUODENAL HEMORRHAGES DANGEROUS TO LIFE.

PROF. DR. HANS FINSTERER,  
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Until quite recent times, the rule laid down by Leube in 1897, von Mikulycz in 1897, and Groenlein in 1906, held good, that in the treatment of acute stomach and duodenal hemorrhages, operation was more dangerous at the stage of acute hemorrhage than when the patient had recovered from the anemia. This doctrine was founded on the fact that operation during the hemorrhage had more deaths resulting than the conservative treatment.

As long as three years ago, and founded on my experience in eighteen cases of the most severe hemorrhages operated upon by me, I expressed the opinion that even during a hemorrhage dangerous to life, we should proceed to operate as soon as possible if we have to deal with chronic ulcers penetrating into the neighboring organs, the reason being that the operation, even in such extremity, brings better results than the conservative treatment by which the erosion hemorrhages from large arteries can never be so positively checked as by resection. Since then, I have operated upon seventeen severe cases, so that I have now for reference 35 cases of operations at the stage of severest hemorrhage.

Hemorrhages from duodenal ulcers are far more dangerous than those from ulcers of the stomach, therefore such cases should be operated upon more quickly, at the seat of the ulcer. Certainly, in the case of an ulcer on the anterior wall, the hemorrhage may be of frequent occurrence, but as it comes only from one vessel of the duodenal wall, it may be treated internally, unless the patient be old with severe arteriosclerotic changes or luetic vascular affections.

In more closely following the history of perforated ulcers, we frequently hear that pain increased several days prior to the perforation, and that the stools were pitch-black. If we operate forthwith in such a case, at the beginning of the hemorrhage, we can, by such timely resection prevent the perforation. Following is a very instructive case:

A man of forty had been suffering from a stomach trouble for twenty years, and had been treated for nervous hyperacidity until a first hemorrhage, with hematemesis, and black stool for six days. Three years afterwards, there was a second hemorrhage, again with hematemesis and black stools. After three months, a third hemorrhage, again with black

stools and vomiting. His condition improved on the following day, but the next day there was a new hemorrhage and syncope. After that, the stools were always black and thin. Three days later, hemorrhage once more, and a stool of pure blood, upon which the physician in attendance advised operation.

At that time the patient was very pale; pulse 120, very small; blood finding 2,016,000 erythrocytes, 21,000 leucocytes, Fleischel 30, color index 0.9, blood pale, hydremic.

In the evening of the same day, the operation was performed under local anesthesia with a one-quarter per cent. solution of novocain, seventy cubic centimeters, and ether 40 cu. cm. as excitant. The stomach was hypertrophic, not dilated, its veins strikingly ectatic. There was a circumscribed fibrinous coating on the anterior wall of the duodenum, three centimeters distant from the pylorus. There, an ulcer was palpated. There were old adhesions between the duodenum and the gall-bladder. There were several stones in the gall-bladder. The stomach itself was empty, but the large and small intestine were entirely filled with blood, which shone through dark blue.

I performed a resection of the duodenum, and of half the stomach, and a typical anastomosis, end-to-side. The course ran very favorably, and complete cure ensued. It is now nearly eighteen months since the operation, the patient has been quite free of any trouble, and has increased 15 kilograms in weight.

The specimen showed a transverse and deep ulcer in the anterior wall, three centimeters distant from the pylorus, and had, at its bottom, only the thin serosa layer, and was therefore on the point of perforating.

The perforation from a bleeding ulcer on the anterior wall may sometimes come about so rapidly that only an immediate operation can prevent it. The following is an example of this:

A man of 53, who had been suffering for 19 years from a stomach trouble, with the typical symptoms of duodenal ulcer, felt particularly severe pains for a period of three weeks preceding a syncope. At the same time, a severe hemorrhage from the intestines appeared, no less than a bedpan full of bright red blood.

The immediate operation advised by his physician was refused by the patient. On the next day, a professor of internal medicine was called in consultation, who, adhering to the old doctrine not to operate in acute hemorrhages, was against the operation, so long as the patient had not recovered from his anemia. After 24 hours, perforation of the ulcer, with diffuse peritonitis, ensued. The operation was not performed until ten hours after the perforation, under generally bad conditions (pulse 130, very small).

It was done under local anesthesia, and forty cubic centimeters of ether administered in drops. There was a large perforation in the anterior wall



of the duodenum, and much of the stomach contents were in the abdominal cavity. The large intestine was full of blood, and the upper small intestine quite drained of blood. Suturing over the perforation was impossible. The pylorus was ligatured, and posterior gastro-enterostomy performed, over-suturing with omentum, then drainage. Death ensued after twenty-four hours.

This patient's life would certainly have been saved if he had followed the advice of his physician, and had been operated upon at once. The hemorrhage from the ulcer on the anterior wall was certainly not fatal, moreover, it was already checked at the time of the operation, probably, because of the reduced blood pressure due to the anemia and the perforation. It is clear that an older person, with a severe anemia, cannot recover from a diffuse peritonitis in addition.

The hemorrhages from the flat ulcers on the anterior wall may not only be very severe, but may be repeated with the same intensity. I cite an instance of this, also:

A woman of 64 has passed through 18 severe hemorrhages of the stomach and the intestine in the course of 24 years. They were so very severe that she had repeatedly been quite drained of blood. Six weeks after the last hemorrhage she was brought to operation with severe secondary anemia, after she had vomited almost everything for many weeks previous.

At the operation, under splanchnicus anesthesia, I found a greatly dilated stomach, and an ulcer of the anterior wall of the duodenum; the posterior wall was completely free. Resection of the duodenum, and half of the stomach was very easy in this case, and the subsequent course was favorable in spite of the severe anemia. The woman increased considerably in weight, and feels perfectly well.

This case is particularly significant in estimating the cause of the hemorrhage. After the long duration of the affection, a chronic callous ulcer was to be assumed. Before the operation, therefore, the hemorrhage might have been attributed to a penetrating ulcer. We might also utilize the case as an example of the fact that repeated hemorrhages from penetrating ulcers can cease even without operation. However, the operation showed that in this case only hemorrhages from a flat ulcer of the anterior wall had to be dealt with.

In an ulcer of the posterior wall of the duodenum, the danger of hemorrhage is particularly great on account of the proximity of the pancreatico-duodenal artery. As a rule, this vessel crosses the posterior wall of the pars superior of the duodenum two centimeters distant from the pylorus, and ad-

jacent to the posterior wall, protected only by the peritoneal cover of the pancreas. It is clear that even a small penetrating ulcer which rapidly spreads deeper down may lead to a fatal hemorrhage by erosion of this artery. But an erosion of the main trunk itself is not necessary,—the erosion of even a larger pancreatic artery is enough to kill, as proven in numerous autopsies.

It has been repeatedly pointed out that hemorrhages from penetrating ulcers of the stomach as well as of the duodenum may cease spontaneously, and that therefore it is not necessary to adhere firmly to an operation during the hemorrhage. I gladly concede that such hemorrhages can cease spontaneously, since in a penetrating ulcer of the posterior wall the hemorrhage may proceed from the erosion of a vessel of the duodenal wall itself, just as in an ulcer of the anterior wall,—but this is not proof that the hemorrhage proceeded from an eroded vessel of the ulcer floor, perhaps from the main trunk of the *arteria pancreatico-duodenalis* and had ceased spontaneously.

In this connection, very instructive is a case upon which I operated, not on account of the acute hemorrhage, but on account of acute *perforation peritonitis*.

A woman of 71 had had stomach trouble for eight years. A rather severe hemorrhage preceded the perforation about a week, but she did not consent to an operation proposed. At the operation, performed under local anesthesia fifteen hours after the perforation, we found a perforated ulcer of the anterior wall of the duodenum with a hole of half a centimeter, and besides this, a second ulcer of the posterior wall penetrating into the pancreas and callos thickening of the pancreas.

The procedure was: Suturing over the ulcer, ligature of the pylorus and alinement with the *ligamentum teres*. Posterior gastro-enterostomy, irrigation of the abdomen with physiological solution of common salt. The operation lasted forty minutes. In spite of the patient's generally bad condition (pulse before the operation palpable only after a saline infusion, cyanotic) and advanced peritonitis, healing progressed without complications, and since then the woman has been in perfect health, and looks well.

If this case had been submitted to operation before perforation, it is doubtful whether the second ulcer on the anterior wall had been found as well as the large ulcer penetrating into the pancreas. In this the proof might, naturally, then have been seen by the fact that the hemorrhage from the penetrating ulcer of the posterior wall had been spontaneously checked.



It is only quite exceptionally that a particularly large duodenal ulcer which extends toward the liver porta, may come to an *erosion of the arteria hepatica* and fatal hemorrhage.

Anatomically, it is shown that, as a rule, the *fatal hemorrhage* is observed only with the ulcers of the posterior wall of the duodenum which *penetrate into the pancreas*. The question would therefore arise whether we are able to establish the seat of the ulcer clinically. A positive differentiation is scarcely possible unless a positive roentgen finding with distinct "niche" is present. However, to establish the seat of the ulcer on the anterior wall of the duodenum, the circumstance may be utilized that the ulcer troubles, present for many years, recur at long intervals, and hence have a pronounced *periodical* character, and that the pain is not intolerable even at the time of the attack and may be checked by morphine, while the ulcer penetrating deep into the pancreas, especially when it spreads to the ligamentum hepato-duodenale scarcely ever has periods entirely free from pain, and the attacks of pain themselves are so violent that they cannot be checked by morphine. Therefore, if in the case of a person suffering for a long time from an *ulcus duodeni*, the pains have at last become unendurable, and are almost uninterrupted, it coming to an acute hemorrhage, we may, with great probability of being correct, say, that this hemorrhage originates from a penetrating ulcer of the posterior wall of the duodenum, by which the danger is present of an erosion hemorrhage out of a large pancreatic vessel, although there may also be the possibility of a hemorrhage from a smaller duodenal vessel at the edge of the ulcer.

As the *prognosis* of the operation is primarily dependent on the *degree of anemia*, it is apparent that the *earliest possible* operation is to the patient's interest. If the anemia has progressed so far that even after the stoppage of the hemorrhage, when, therefore, no more blood is lost, the patient succumbs to the injurious consequences of the anemia, the operation can effect no cure. Therefore, it is advisable to bring the patients to operation before they have lost too much blood.

Of the various methods of operation, I have, hitherto, employed two:

First, the indirect arrest of hemorrhage by complete *exclusion of the ulcer* (ligature of the pylorus with simultaneous gastro-enterostomy) and compression of the duodenum by a large tampon.

Second, *resection of the ulcer*, with direct ligature of the bleeding vessel.

The first method is certainly simpler and sure of success provided that a sufficiently large tampon is laid on the duodenum, by means of which the latter is afterwards pressed against the spinal column by a compression bandage, and thus the anterior wall of the duodenum is forced against the bleeding ulcer bottom as if pressing on the part with the finger.

I have operated upon 22 cases of duodenal ulcer at the stage of severest hemorrhage, ten times with exclusion. In six cases hemorrhage was successfully checked, and cure effected. Four cases died in spite of the operation. In one case it could be demonstrated at the autopsy that the hemorrhage had been completely checked (as the small intestine, which had been quite full of blood during the operation, was now empty). One of the above-mentioned cases died of simultaneous perforation peritonitis. One case succumbed to anemia, already present. The fourth patient died on the fourth day after the operation quite suddenly, probably owing to renewed hemorrhage. Here the compression of the duodenum was insufficient owing to lack of gas. Exclusion has the advantage of being easily performed, though it is less reliable than resection wherein the bleeding vessel is ligatured.

The opinion that resection of the *ulcus duodenali* is too difficult and dangerous to perform has been refuted by the good results. In a bleeding ulcer of the anterior wall, the resection is just as easy as an ordinary stomach resection. In ulcers of the posterior wall penetrating into the pancreas, I detach the duodenal wall from the ulcer, leave the ulcer base in the pancreas, and ligate the exposed bleeding artery. I have now performed resection of the duodenum at the stage of severest hemorrhage twelve times, three times on an ulcer of the anterior wall, and nine times on a penetrating ulcer of the posterior wall. Of these twelve patients, only one died after the operation, a man thirty-three years of age, who had had stomach trouble for six years, and a seven days' continuous hemorrhage. After fruitless internal treatment, in a dying state (pulse no longer palpable at the wrist for twenty-four hours, 160 in the arteria carotis) he was sent to operation, at which the eroded arteria pancreatico-duodenalis was ligated at the ulcer floor.

All the remaining cases were cured, although the early operation could be performed only in two cases. The other cases had been sent to operation only several days after the beginning of the hemorrhage, and fruitless internal treatment in a state of severest acute anemia.



The mortality of my resections being 8.3 per cent. is therefore not much more than the mortality of duodenal resections in general, (hitherto, in 131 resections of the duodenum, I have had only six deaths, therefore a mortality of 4.5 per cent. This mortality has decreased to 1.2 per cent by the 80 cases of the last 2½ years). If it is possible to bring the operation within the first 24 hours for cases of acute hemorrhage, resection during the hemorrhage will yield equally good results.

In the stages of acute hemorrhage, I always remove half the stomach in order to permanently remove the hyperacidity, and to avoid the relapse of the ulcer and *ulcus pepticum*.

To attain good results, it is necessary to take into consideration the general condition of the patient. The *exclusion of general narcosis in favor of local anesthesia* is, I consider, one of the most important conditions. Even in deep ether narcoses, the danger of aspiration is very great. Also, in cases of excessive anemia, novocain must be applied very sparingly (only a one-quarter per cent. solution instead of one-half per cent.) while a few drops of ether or intravenous ether injection may be given as a stimulus to avoid collapse.

I would caution against a splanchnic anesthesia in higher degrees of anemia. We must also be very cautious in giving *morphine* before the operation, and must always bear in mind that 0.02 morphine means as much for a bloodless person as 0.2 for a normal one.

As the acute hemorrhage from an *ulcus duodeni* always signifies a great danger for the patient, and as fatal complications (perforation, bleeding to death) can never be avoided with certainty by internal treatment, I consider the early operation necessary in every hemorrhage, i. e., during the first twenty-four hours.

My choice of method is resection of the duodenum, and of half the stomach with direct ligature of the bleeding vessel. If the ulcer penetrating into the pancreas reaches the papilla, then the resection is technically impossible, and the hemorrhage is checked by complete exclusion of the ulcer, and its compression by the duodenal wall.

#### NON-OBSTRUCTING ULCERS.

Gastro-enterostomy alone is a useless operation for an ulcer that does not obstruct the stomach outlet. Such an ulcer should be destroyed, excised, or resected, or, if conditions do not permit this, the pylorus should be closed by purse-string suture.

## SOME NEEDED IMPROVEMENTS IN OUR MINOR SURGICAL SERVICES.\*

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It has for some time seemed to me that the surgical dispensaries of our general hospitals fall far short of as high a standard of work as it is easily feasible to obtain. The same applies with perhaps more force to the minor dressings we do in our private offices. Even if there are discrepancies in these two points of contact, it might appear that they must be too slight and inconsequential to deserve notice, time and attention. A little laxness of methods may mean only a few days' further disability in an individual case, yet so many thousands of people are cared for in our dispensaries and offices that only a few days multiplied by these thousands of cases represents an enormous sum in unnecessary time and money lost by employees.

I shall very briefly—almost by “tabulation”—indicate what seem to me the chief points needing consideration. These are:

1. Routine treatment.
2. Imperfect general cleanliness.
3. Excessive granulations.
4. Dry dressings.
5. Too-long-delayed motion.
6. Infective use of “antiseptics.”
7. Failure to remove necrotic or foreign material.

1. *Routine treatment.*—Is it not the case that in our dispensaries and offices some “favorite” method is applied to practically all cases in the rush of a busy morning's work? Yet but few cases are best treated by any one method, no matter how good. Some cases need ointments; some need balsam; some need antiseptics; some are held back by antiseptics; a few need dry dressings; many need massage and motion; some need sun or electric light; some need nothing but soap; some wounds do best if left entirely alone. Ninety per cent. of all cases will get well a few days or even a few weeks quicker if their own particular needs are supplied rather than the “favorite” routine of the spot in which their ways may have fallen.

2. *Imperfect general cleanliness.*—This is perhaps the most frequent failure. Go to any dispensary and you will see wound after wound with dead, soggy, bacteria-laden epithelium at its edges or near-

\*Read at the 30th Annual Session of the New York and New England Association of Railway Surgeons, New York City, 1920.



by; old dried blood-clots of weeks ago are still there. If it is near the finger tip, the nail and cuticle around the sides and base are a disgrace to an American school boy. We never have had an old case treated elsewhere come into our dispensary with a "clean-shaven, well-groomed" wound. If I were limited to one substance for surgical dressings I would with no hesitation choose any good soap.

3. *Excessive granulations.*—A question akin to No. 2. How often can we find wounds with excessive protruding granulations that the ingrowing skin edges have to slowly grind off if they are ever to come together at all. A wound with protruding granulations is a neglected wound.

4. *Dry dressings.*—Fortunately the present styles in antiseptics have to an extent diminished dry dressings. But, even so, their use is only too frequent. The way the patients yell when they come off would be sufficient objection. Nature, at best, has a hard task, but it must often get discouraged when it sees a doctor pull off, in the morning, in the dry, hard, adherent gauze dressing all the new epithelial cells it has been able to produce during the night. Except in case of primary suture, I know of very few wound conditions that are best treated by a dry dressing.

5. *Too-long-delayed motion.*—The other questions discussed effect principally the duration of temporary disability. Delay in starting active motion is the principal factor influencing prolonged or permanent stiffness or other loss of function. Active motion should often be insisted upon at the very first dressing. A fibrin patch in a joint or tendon sheath may be so well established after twelve hours that it will form a permanent crippling adhesion. Physical treatment is amply provided for in some institutions, but even in these, it is necessary for the patient to be up and about before he can get it. Many fractures should have active motion in all neighboring joints from the first day. If at all applicable, the best apparatus for a fracture is the thick cotton wrapping, introduced, I believe, by Hawley. With this the patient has considerable motion in nearby joints.

6. *Ineffective use of antiseptics.*—When antiseptics are needed, are they often used with reasonable efficiency? Is the Dakin fluid or Dichloramine-T applied with care enough to allow it to have any effect at all? The greatest difficulty with antiseptics, however, is that their application in any form is too often seized upon as a substitute for the detailed care needed to produce ordinary mechanical cleanliness. If the latter is obtained, antiseptics are rarely

needed. Dr. W. T. Bull many years ago said that most trained nurses would have been just as good if they had been trained in a soap factory. I have only just recently understood what he meant. I have myself at times felt that our hospital house-keeper would take better care of our surgical dressings than the professional staff—she would at least keep them clean.

7. *Failure to remove necrotic or foreign material.*—How many cases are drifting around our dispensaries month after month with persistent sinuses? Yet, the only thing that makes any wound persist after a reasonable time is necrotic bone, necrotic tendon or a foreign body that nobody takes the time and trouble to remove.

## PRIMARY SARCOMA OF THE INTESTINES. A REVIEW OF RECORDED CASES.

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CAMDEN, N. J.

(Concluded from the August Issue.)

Simon Flexner's cases (1893) occurred:

(1.) In a man, aged 27, emaciated. Had a new growth of small intestine 2x3.5 cm., and several growths in the mesentery and other portions of the small intestine. Stomach, adrenals, liver, and pancreas show no tumors. Only one growth found in the liver. No traces of any metastases from the intestinal tumors, except the one in the liver. The mesenteric, retroperitoneal, and cervical lymph nodes all normal.

(2.) In a girl 11 years old, apparently well, to the date of death. Autopsy by Councilman. The lymphatic tissues all markedly hypertrophied. The swelling well marked in the stomach and intestines, and was not limited to the lymphoid follicles. Lymphosarcomatosis quite general—affecting the duodenum and jejunum and ileum, also the liver. Stomach and kidneys not examined microscopically. Flexner's article covers 38 pages in the *Johns Hopkins Hospital Reports* (Pathology, iii), and includes 89 references on the subject of multiple lymphosarcomata.

Cautley's case (1919) was an abdominal alveolar sarcoma with metastases in the skull. It was a pre-vertebral (lumbar) sarcoma, with glandular involvement. The patient was a male aged 2½ years. No mention made of the stomach, liver, intestines, or pancreas.

Homans (1897) reported a case of sarcoma in the cecum.



Perera's case (1919) was one of congenital multiple sarcomatosis; rounded and nodulated tumors were scattered throughout the body—abdomen, head, chest, extremities.

Booth's case (May, 1920) was in a man aged 34 years, a laborer in a cemetery. Tumor of small intestine 4 feet from the pylorus, mostly in the left hypochondriac region. It was a primary small round-celled sarcoma of the small intestine. Duration one year. Fever resembled typhoid.

M. B. Clopton (September, 1920) in his article on "malignant tumors in childhood" mentions a case of intestinal sarcoma in a girl aged 5 years. The neoplastic mass was situated about 12 cm. from the duodeno-jejunal junction and extended downward over 20 cm., the wall of the tumor varying from 9 mm. to 2 cm. At one point there was a small perforation. Metastases were present in the mesenteric glands and in the peritoneum, small tumors being found in the hernial sacs. The tumor was made up of round and oval cells in the meshes of delicate fibrous tissue, and was thought to arise in the submucosa.

Clopton mentions another case operated on elsewhere, the parents being told that the child had a sarcoma of the intestines. Nothing could be done for this child and it left the hospital without treatment.

He advises the use of Coley's toxin, radium and roentgen-ray therapy for the sarcomatous tumors.

J. L. Ransohoff and A. Friedlander, of Cincinnati, discuss "Fibrosarcoma (mesentery)—"Solid Tumors of the Mesentery" in *Ann. Surg.*, February, 1921, LXXIII, No. 2. In their case the man, aged 73 years, showed a mass the size of an orange, which did not seem movable. The patient himself was unaware of its presence. Operation January 17, 1920. A fibro-sarcoma the size of a fetal head was found in the mesosigmoid, just above the rectosigmoid junction. Twelve inches of sigmoid were resected, and an end-to-end anastomosis made. Shortly after operation, recurrence was noted.

The first mesenteric tumor successfully operated upon was a cyst, reported by Tillaux, in 1880.

Vance in 1906 collected 27 cases reported in the 5 previous years. Of these 7 were sarcomata, 1 carcinoma, and the rest were benign tumors of neoplastic origin.

Speese (1914) mentions 99 observed cases of intestinal sarcoma in which the type is mentioned: Lymphosarcoma 34, myxosarcoma 2, round-cell sarcoma 43, myosarcoma 2, spindle-cell sarcoma 13, melanotic sarcoma 1, fibrosarcoma 3, mixed-cell sarcoma 1. Speese was able to collect 12 additional cases of intestinal sarcoma since Lecène's report of

89 cases in 1904, making a total of 101 primary sarcomata of the small intestine, collected from the literature. Of 53 cases studied—the ileum was involved in 32; the duodenum and jejunum in 3; jejunum 12; jejunum and ileum 2; and entire intestinal tract 4. Of the 101 cases, Speese found 67 in males and 34 in females, or nearly twice as many in the male sex.

#### PRIMARY SARCOMA OF MESENTERIC LYMPH NODES DIRECTLY INFILTRATING SMALL AND LARGE INTESTINES.

Autopsy No. 3815—14—1912, XXIV. (Univ. of Penna.)

Died at the University Hospital, March 1, 1912, at 7 A. M.

Service of Dr. John B. Deaver.

Autopsy performed by Dr. Lynch.

Levi, E., white, male, aged 51 years.

*Clinical Diagnosis*—Suspected carcinoma of intestine with perforation.

*Gross Anatomical Diagnosis*—Chronic mitral valvulitis; pressure atelectasis of lungs. Nephrolithiasis.

Metastatic carcinoma of liver, last part of the duodenum; hepatic flexure of colon, and lymph nodes (mesenteric).

*Histological Diagnosis*—Primary alveolar sarcoma, primary in the mesenteric lymph nodes, extending into the intestines.

*Small Intestine*—At the junction of the duodenum and jejunum, the mucosa is covered with small, flat, soft nodules, which are not ulcerating, is densely adherent to the surrounding lymph nodes, and apparently the perforation has occurred through one of these adherent lymph nodes. The new growth is infiltrating the upper coats of the hepatic flexure of the colon. The pancreas and stomach, gall-bladder and bladder are normal.

Sections of small intestine show a new growth of infiltration in all of nodes and especially in the outer coats of the intestine, at one point penetrating into the mucosa. This has an arrangement like alveolus, whose wall is composed of spindle-cells and whose space is filled with oval-cells of fairly uniform size about the dimensions of an embryonic connective tissue cell, with relatively large amount of cytoplasm and hyperchromatic nuclei, with occasionally more than one to the cell, held in loose fibrillar network. Few mitotic nuclei are seen and the bloodvessels, which are numerous, in the nodes, are composed of a thin wall of young spindle-cells. In certain places these cells are arranged more or less perpendicularly to the wall, but generally there is no typical arrangement. Some lymphoid areas remain in the glands.

In a fairly thorough study of the literature on the subject of primary sarcoma of the stomach, tongue, esophagus, small intestine, large intestine (and rectum), gall-bladder, pancreas, and liver, I have been able to find only about 592 cases, all told, (of these,



there were a small number which could not be accepted without some doubt as to the primary origin). In this list, the largest number, 265, including the 3 cases I reported, Karsner's case, Hertzler's case, Terry's (2), Moffitt's, Einhorn's, Höglers, and the one case at Johns Hopkins Hospital, examined by Dr. Bloodgood, occurred in the stomach; only 17 in the appendix; 130 in the large and small intestines; 16 in the gall-bladder; 65 in the tongue; 21 in the esophagus; 19 in the pancreas; and 59 in the liver. It will therefore be seen that in the entire gastro-intestinal tract, including the tongue, esophagus, stomach, and large and small intestines, appendix and rectum, there are only about 498 cases of primary sarcoma on record in the available literature of the world; and that there are not over a hundred cases, authentic and accepted, recorded in the entire available literature, of primary sarcoma involving the pancreas, liver and gall-bladder.

W. Maxwell Telling (1920) reported a case of primary spindle-celled sarcoma of the small intestine causing variable but considerable obstruction, due probably to a kinking or angulation at the site of the tumor. There was only one solitary tumor 2 or 3 inches over all, the oval growth itself was  $1\frac{1}{4} \times \frac{3}{4}$ "; no detectable enlargement of the mesenteric glands was present. The patient was a boy aged  $3\frac{1}{2}$  years—who had had intermittent attacks of abdominal colic for about seven months. The attacks at first came on about every 3 or 4 days, and lasted from one-half an hour to an hour. The attacks of colic increased in severity and duration till they were occurring daily and lasting for several hours. No blood had ever been noted in the stools. Three inches of bowel were excised. (*Brit. Jour. of Child's Dis.*, XVII, Oct.-Dec., 1920, Nos. 202-204, p. 192-195). Telling reported the case before the Royal Society of Medicine, June, 1920, (Sect. Dis. in Children), at Manchester, England.

V. Sala (*La Pediatria*, 1920, XXVIII, p. 526) records a fatal case of small-celled sarcoma of the omentum in a boy aged 4 years. He emphasizes several important points: (1) that omental tumors may grow very large in children, and that therefore they may lose their mobility, (2) pain is an almost constant symptom of omental tumors, (3) pressure symptoms (pressure on adjacent organs) almost entirely dominate the clinical picture, and (4) suddenly death is liable to occur, due to compression caused by the enormous development of the tumor.

C. F. Karsner discussed "Syphilis of the Colon and the Lower Bowel" with report of 3 cases. (*Annals of Medicine*, Vol. I, No. 2, p. 237, July 1920).

In May 1918, a white female aged about 60 years, died in the University Hospital, Phila. At autopsy primary endothelioma of the small intestine (ileum) was found. The patient, M. E. P., was in the service of Professor Alfred Stengel. The autopsy was performed by Dr. Fred D. Weidman. Sections were examined by Professor Allen J. Smith (Univ. of Penna. Autopsy Records 5827-1918-No. 77, Vol. XXX, p. 249-254).

I wish to thank Professor Allen J. Smith of the University of Pennsylvania for his assistance and for the privilege of reviewing the autopsy records of the University of Pennsylvania and for using some of the notes with reports of the cases included in this paper.

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- 1425 BROADWAY.

## A CASE OF CONGENITAL ATHEROMATOUS (DERMOID) CYST OF THE UMBILICUS.

E. DARGAN SMITH, M.D.,  
LOUISVILLE, KY.

This case is reported because of the extreme rarity of atheromatous cysts of the umbilicus. A search through the literature has failed to reveal a case report by any American observer.

On October 2, 1918, F. C. G., age eleven, came to my attention with a tumor mass attached to the umbilical cicatrix.

At birth, or immediately after the cord came away, a pedunculated growth, approximately one centimeter in diameter, was observed protruding from the umbilical depression. The tumor had always been reducible until one year before coming under observation.

There had been no pain nor was the growth tender on pressure. It was not decreased in size by firm taxis.

The consistency of the tumor was suggestive of lipoma. It was conceivable the condition might be an umbilical hernia containing a small omental tag, which had been shut off from the abdominal cavity.

The skin was thinned, of normal color and with prominent bloodvessels. The ribbon-like pedicle measured 2x5 mm., while the cystic portion, which had increased rather rapidly in the preceding five years, measured 2x3½ cm.

Operation, October 8, 1918. Transverse elliptical incision four cm. in length. No abnormal attachment to the umbilicus from within was found. The peritoneum was closed and the fascia overlapped from above downward, as advocated by Charles P. Noble and Wm. J. Mayo in closure following umbilectomy.

Recovery from the operation was prompt. The patient has since remained well.

The umbilical specimen was submitted to Dr. Stuart Graves, who experienced difficulty in securing satisfactory sections. He reported the following gross description:

"Specimen consists of elongated umbilicus with adjacent skin removed with proximal end. When cut surface of latter is stretched out a small dimple covered with delicate membrane is seen in the middle. When this membrane is nicked a probe can

be inserted along a canal lined with similar membrane, smooth and glistening and pale, to distance about 18 mm. By opening along inserted probe, canal is found to terminate at end of probe. There has thus been opened a closed canal about 3x18 mm. lined with a membrane similar to peritoneum. Distal to end of canal a knob-like portion extends about 15 mm. This is flabby and covered with pale, smooth skin. When opened, it presents a cavity about 1 cm. in diameter filled with pasty, pale, granular material, rather dry. Under high power this is seen to be crystalline in nature, dissolving in a mixture of absolute alcohol and ether and taking Scarlet R. stain in fine droplets, the larger material not being dissolved and not taking the stain."

On account of the uncertainty as to the nature of the growth, a history of the case, together with the main portion of the tumor, was sent to Dr. Thomas Cullen in Baltimore. His communication of March 24, 1919, stated in part as follows:

"We had practically the same experience that you did. It was almost impossible to get satisfactory sections. We cut sections and they were no good. We reembedded the tissue and cut more, still it has been almost impossible to cut sections thin enough.

The cyst is lined by an embryonic epithelium apparently of the squamous-cell type. In some places it is two layers or more in thickness, the nuclei are oval and vesicular, but the individual cells are not well differentiated. At other points there is a definite squamous epithelium several layers thick and covering the surface is what appears to be an ill-defined horny epithelium. Without doubt, we are dealing with a small atheromatous cyst."

Since there are only a few of these cases on record, little originality is possible in reviewing and abstracting the literature. On that account, I am taking the liberty of quoting from Cullen's treatise on "The Umbilicus and its Diseases" (W. B. Saunders Co., 1916):

"After carefully analyzing the cases of supposed dermoids or atheromata of the umbilicus that are available in the literature, I have found among them only six that were true umbilical dermoid cysts. These were reported by Küster, Lotzbeck, Morestin, Lannelongue and Fremont, Hue and Guelliot. These atheromatous tumors were all noted in young patients. In three they were found at birth, in one after the cord came away, and in the remaining two they had been present since childhood.

"A dermoid cyst may spring from the umbilical cicatrix or from the side of the umbilicus. It may reach the size of a walnut and tend to become pedunculated. It may be tense or occur as a flaccid sac. It contains sebaceous material, which, on histologic examination, yields epithelium, fat-droplets, and frequently cholesterolin crystals. The cyst-walls examined histologically have shown an inner lining of squamous epithelium devoid of hairs or glands of any sort, and in none of the cases have hairs been detected in the cyst contents.

"The skin covering these cysts is, as a rule, unaltered. In Morestin's case, however, as a result of the rubbing of the clothing, it had become reddened at one point and slight suppuration had occurred, followed by discharge of the characteristic cyst contents."



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, OCTOBER, 1921.

## THE SURGICAL TREATMENT OF ACUTE PELVIC INFECTIONS IN WOMEN.

"The treatment of acute gonorrheal pelvic inflammatory disease is never surgical." We quote this from page 415 of the latest American text-book of gynecology.\* It is a terse and forcible expression of the generally accepted view concerning the management of acute infections of the female pelvic organs. It is based, not on any theoretic considerations, but upon the accumulated experience that radical operations in acute infections of the adnexa have been attended with a high mortality and that, moreover, as the subsequent course of many of these cases shows, they are often unnecessary.

In the September issue of *Surgery, Gynecology and Obstetrics*, F. G. DuBose, of Selma, Ala., disputes the wisdom of this conservatism. He says, "a review of the literature on this subject contributed during the last decade is convincing that mortality and morbidity following the non-operative, the expectant plan, and the conservative-surgical is frightful indeed." In his practice "immediate operation is done in all cases which present the syndrome of acute surgical pelvis if first seen within twelve hours after the onset of the infection"! If

seen after the first twelve hours he delays for a period of observation (usually, it would appear, only a brief one), but not beyond a week, and not at all if a mass is found in the pelvis!

DuBose reports "255 pelvic inflammatory cases operated upon consecutively," in three years, with but one death. This would indeed show that primary, radical operation in acute infections of the female pelvic organs, in his hands, can be conducted with but a very small mortality percentage. It is, it must be conceded, a remarkably good record and a statistical tribute to the late Joseph Price of Philadelphia, whose technic DuBose appears to follow.

But an analysis of the statistics presents ground for arguments from other standpoints than that of safety. In these 255 cases the uterus was removed in 80 (indications not stated); both tubes in 76; one tube or one ovary, or one tube and one ovary in 98; both ovaries were sacrificed in 31 (ages of patients not stated). The objection to primary operation in these acute infections is not wholly, nor chiefly, the dangers of the proceeding. It is based also on observations of the subsequent developments in these cases.

It is quite true that the infection does not always become quiescent, nor the pus sterile. Sometimes it continues or recrudesces, and occasionally with fatal consequences. DuBose refers to the editor's article on Rupture of Pyosalpinx as a Cause of Acute Diffuse Purulent Peritonitis\* in which, reporting a case successfully operated upon, we collected 91 recorded cases, with 54 deaths, these latter including 36 not operated upon. It must be remembered, however, that rupture of a pyosalpinx into the peritoneal cavity "if not rare, is at any rate very unusual," that many of these were neglected cases, and that all but two that were operated upon promptly, recovered. Of this accident, which represents the most serious development that can threaten in acute—or chronic—pyosalpinx we said "rupture is a complication too infrequent to gainsay the conservative treatment of pyosalpinx, but sufficiently common to be borne in mind in the management of every case of purulent tubal infection" . . . "attacks of severe pain and fever, repeated within a short time, should suggest the possibility of impending rupture and the desirability of replacing conservative with operative treatment." Close observation in all cases will, similarly, give indications for abandoning conservatism when such indications arise."

\*Gynecology. By Brooke M. Anspach, M.D., Associate in Gynecology, University of Pennsylvania. J. B. Lippincott Company, 1921.

\*Brickner: *Surgery, Gynecology and Obstetrics*, May, 1912.



That chronic pelvic disease, and even occasional fatalities, may follow the avoidance of primary radical operation does not warrant, we believe, "immediate operation in all cases . . . if seen within 12 hours after onset of the infection" or in all cases after a week or as soon as a mass is felt in the pelvis. Even were such operations as safe in all hands as they are in those of DuBose, it is quite evident that in this acute stage conservative surgery is well-nigh impossible, and organs or parts of organs that, at a later stage, might well be spared, must needs be sacrificed. DuBose's records show this.

While a small percentage of acute gonorrheal, and other, infections of the adnexa develops peritonitis, early or late, and a larger number produce other serious but more localized suppurations, the great majority run a milder course and can well be allowed to regress to that stage where a conservative operation will be safe and adequate. This is the more important since so many of these cases are of recently married women, with no children, in whom the possible restoration of fecundity is important.

Instances to the contrary notwithstanding, the tendency in gonorrheal pyosalpinx is for the pus to become sterile, the exudate and accompanying pelvic peritonitis to disappear, and the threatening mass to develop into a relatively harmless hydrosalpinx or even to subside more or less completely. In a goodly percentage of the cases that DuBose would operate upon at once, the pelvic infection will regress, under conservative treatment, to a symptomatic recovery, often with little or no palpable remnant of the disease.

It would seem to us just as logical to advocate the removal of every testicle and vas deferens acutely infected with gonorrhea, as to remove within twelve hours, or in a week, ovaries and tubes involved in so early an infection of the pelvis.

While we believe that DuBose has not made out a good case for immediate radical treatment in acute pelvic infections in women, his publication has emphasized that simple vaginal drainage of an abscess in these cases is sometimes a very insufficient procedure, that pelvic pus pockets "by no means regularly become sterile" and may be a source of real danger even after several years, and that radical operation, even in the acute stage of infection, can be conducted safely.

In passing, we can not refrain from commenting upon a technical point. DuBose operates through a median incision. We have elsewhere pointed out

that median hypogastric incisions (i.e. through the linea alba itself) are not desirable since they are too often followed by herniae, even in undrained cases. DuBose uses massive gauze drains, and it would seem to us highly probable that many of his patients develop hernia.

### CANCER WEEK

The American Society for the Control of Cancer has selected October 30th to November 5th for a period to be designated "Cancer Week" in which to spread throughout the United States and Canada—by lectures, literature and posters—the message of cancer control, a propaganda of preventive medicine.

The individual physician not actively engaged in the campaign can nevertheless help it much by impressing upon his patients the great importance of periodic examinations. Thousands visit their dentist two or three times a year for inspection. How many have learned the importance of regular medical inspection?

### SURGERY IN CHILDREN—ANNOUNCEMENT

We had expected to make the November issue a special number devoted to surgery in childhood, but we have so many contributions on general surgery awaiting publication that we feel obliged to postpone this special number until a more favorable time.

## Progress in Surgery

Selections from Recent Literature  
H. Lyons Hunt, M.D., L.R.C.S., (Edin.)  
Abstract Editor.

**Fractures of the Carpal Scaphoid.** ALAN H. TODD, London. *The British Journal of Surgery*, July, 1921.

The great majority of the cases of fracture of the carpal scaphoid appearing in the author's clinic are examples of old fracture, and the reason for attending is invariably the same, i. e., that the patient has not the same function and use of the wrist that he had before the injury. The majority of these cases have been treated as sprains through misdiagnosis. In general surgical clinics, cases of recent fracture of the carpal scaphoid are practically never seen, and the writer concludes justly that a number of cases of this fracture are overlooked, either do not come to the hospital at all, or are to be looked for in the minor casualty departments, being treated for sprain; and second, given a due appreciation of the likelihood of such an injury, and being given also an opportunity for radiographic examination, such a fracture should not be overlooked.

In all cases of old fracture, the condition of the wrist was such as to materially interfere with the man's wage-earning capacity. While a definite history of the casualty can usually be obtained, the exact etiological mechanism is not always possible to determine. The writer believes the majority of cases are due to a fall on the outstretched arm while the wrist is hyperextended. The first sign of the fracture is swelling which appears almost at once and is most marked in the region known as the "anatomical snuff-box", never great, and never widespread; the tendons that form the boundaries of the snuff-box may be obscured, and the edema may spread a little way upward,



tending rather to follow the line of the lower end of the radius; but it never surrounds the whole wrist. The folds at the wrist are never obliterated. Limitation of extension of the wrist-joint is present from the first. Flexion is possible. There is no muscular wasting at any stage. Radiography should be employed at all times but, without the proper technic, fractures of the carpus are easily overlooked. A routine treatment of these cases consists in preliminary splinting for three or four weeks, followed by mobilization and the employment of all the usual physiotherapeutic measures, such as whirlpool baths, contrast baths, or radiant heat baths. When the hyperemia and other callus-promoting conditions have subsided somewhat, it is indicated to restore mobility and function.

Operation will usually give good results by excising one or both fragments. Operations can be performed under local analgesia. An incision is made on the dorsum of the wrist, along the anatomical snuff-box; it is deepened, the radial nerve and artery being held aside; it goes down parallel with the tendon of the extensor carpi radialis longior, and to the inner side of it, care being taken to avoid opening its sheath; the bone having been removed, the skin is sutured, no attempt being made to close the joint-capsule. The wrist is bound up and the patient is encouraged to make such movements as the bandages allow from the very first, and a little later on, massage is instituted. It is apparently immaterial whether the whole scaphoid is removed, or only part of it; the wrist is certainly not weakened in any perceptible manner by the removal of the whole bone, but the results of operation seem to have been as good when the proximal fragment alone has been excised. The writer calls attention to the fact that in the bibliography of fractures of the scaphoid, it is significant that all methods of late treatment are uncertain and unsatisfactory, and that accurate diagnosis of the fracture in the first instance is essential to uniform success in treatment. The article is profusely illustrated.

#### A New Method of Treating Recent Fracture of the Os Calcis. DAVID C. STRAUS, Chicago, Ill. *Journal of the A. M. A.*, July 16, 1921.

In the great majority of cases this fracture is due to a fall from a height. When the foot strikes the ground, the os calcis is suddenly held rigid while the weight of the body is transmitted to the astragalus, which acts as a wedge. The tuberosity of the os calcis is forced upward by the impact. As a result, the line of fracture usually extends downward from the concave articular facet beneath the wedge-shaped, articular surface of the astragalus. Not only is the posterior fragment of the os calcis driven upward by the impact at the time of fracture, but it is held in this position by the constant tone of the Achilles tendon. The latter presents the chief obstacle to reduction. The longitudinal arch of the foot gives way at the time of fracture, with a resulting traumatic flat-foot.

Straus evolved the following method of treatment:

The patient is placed on a Hawley table under ether anesthesia. Subcutaneous tenotomy of the Achilles tendon is performed. A long Steinmann pin of the latest model, which screws together at its center, is used. After the upper surface of the body of the os calcis immediately in front of the Achilles tendon on the medial side of the foot has been palpated, the Steinmann pin is pushed through the skin, from the medial to the lateral surface of the heel, so as to avoid striking the posterior tibial vessels, and so as to lie immediately above the body of the os calcis and immediately anterior to the Achilles tendon. The pin extends an equal distance beyond each side of the foot.

Over a dressing the Steinmann caliper is applied to the pin, and downward traction is effected by an assistant. The reduction is then made in the usual manner. Any impaction is broken up. The posterior fragment is drawn strongly downward, while the anterior portion of the foot is forced downward and strongly inverted, while counterpressure upward is made against the anterior fragment of the os calcis and the arch of the foot, by means of an orthopedic block. The block also aids in correcting the median displacement of the astragalus while the foot is held in the corrected position, and sheet wadding is applied from the knee to the toes. A plaster-of-Paris cast is applied, reach-

ing from the tuberosity of the tibia to the heads of the metatarsal bones. While waiting for the cast to set, continuous traction downward is maintained and upward pressure on the anterior fragment and the instep is secured by use of the orthopedic block, care being taken to hold the astragalus in its proper position. This position is maintained until the plaster has set. The Steinmann pin is now unscrewed and each half is removed. Since the two portions of the pin are removed from within outward, there is no danger of infection. This is further guarded against by injecting, with a medicine dropper, a few drops of tincture of iodine through the holes in the plaster cast left by the removal of the pin.

The cast is left on for four weeks. Then passive motion is begun, with massage and hot footbaths, daily. The patient is not allowed to bear any weight on the foot till the end of ten weeks. He is then fitted with an arch support, and begins to walk with the aid of crutches.

#### A Study of the Ossification Centers of the Wrist, Knee and Ankle at Birth, with Particular Reference to the Physical Development and Maturity of the Newborn. FRED L. ADAIR and RICHARD E. SCAMMON, Minneapolis, Minn. *The American Journal of Obstetrics and Gynecology*, July, 1921.

The study was undertaken with the object of determining the condition of the ossification centers of the wrist, knee and ankle in the newborn, their interrelationships, and particularly their relation to the maturity and to the size of the child. Incidentally were considered the effect of parity and sex upon the condition of these centers at birth. The material consisted of 100 newborn children (45 females and 55 males) taken *seriatim*. Each of these children was weighed and was measured for total length, and radiographs were made of the ankles, knees and wrists of both sides within 48 hours after birth.

The authors make the following summary:

1. The inferior femoral epiphysis, judging from all available data, is present in about 1 case in 20 in the eighth fetal month, and in 1 case in 3 in the ninth month, in 6 cases in 7 in the tenth month, and in about 19 cases in 20 at birth (full-term infants). If not present at birth, the center appears before the close of the first postnatal month. In this series the center was present in 98 per cent. of all newborn children.

2. The superior tibial epiphysis, judging from all available material, is almost never present before the ninth fetal month. It is found in 1 case in 17 in the ninth month, about 2 cases in 5 in the tenth month and in about seven-eighths of all full-term newborn children. It was present in 81 per cent. of the cases in our series.

3. The cuboid, according to all available data, first appears at about the beginning of the ninth fetal month. It is present, on the average, in about 1 case in 25 in the ninth month, in about 1 case in 4 in the tenth month, and in about 3 cases in 5 in full-term newborn children. In this series the center was present in a much smaller per cent. of all cases than is reported by other investigators (38 per cent.).

4. Two carpal ossification centers, those of the os capitatum (os magnum) and of the os hamatum (unciform), may be present in the newborn. In our series the os capitatum was present in 15 per cent., and the os hamatum in 9 per cent. of all cases.

5. There is a close relation between total body-length and frequency of ossification of the several centers discussed in this paper. A similar, but less close, correlation exists between frequency of ossification and the body-weight.

6. In this material the correlation of body-weight, total body-length and frequency of ossification with menstrual age was quite close for the middle members of the series ranging in menstrual age from 270 to 300 days. But the outlying cases (having a menstrual age of less than 270 or more than 300 days) show little relation between these measures of bodily development and age as determined from the menstrual history.

7. Our evidence points to the conclusion that ossification proceeds slightly more rapidly in females than in males during intrauterine life even though the weight and dimensions of the females are less than those of the males.



8. Our observations show no direct evidence of any relation between parity and the rate of ossification in intra-uterine life.

9. Variations in the number of ossification centers present for individual bones were limited to the os capitatum and os cuboideum. The latter is formed from an extremely variable number of centers. When anomalies in the number of centers are present they are often asymmetrical.

10. Variations in the order of appearance of centers were decidedly unusual in our material, being confined to premature ossification of the os cuboideum (2 cases) and of the premature ossification of the os capitatum (2 cases).

11. The usual order of appearance of the centers under consideration is as follows: (a) Inferior femoral epiphysis; (b) Superior tibial epiphysis; (c) Cuboid; (d) Os capitatum; (e) Os hamatum.

**Differential Diagnosis in Destructive Lesions of the Great Trochanter.** Report of Two Illustrative Cases. C. W. PEABODY, Boston. *The Boston Medical and Surgical Journal*, July 28, 1921.

The author reports the result of studying two cases interesting on account of many points of similarity. In one case, the progressive course was not influenced by any constitutional or hygienic treatment or by rest of the part. A marked sensitiveness in a subcutaneous area lacking any of the cardinal signs of inflammation and diffuse changes as shown by x-ray examination indicate neoplasm. A more chronic course, the exacerbation of symptoms on use, with alleviation by rest, and the circumscribed, moderately reactive x-ray picture, point toward tuberculosis. After a careful search of hospital records, the writer reports that tuberculosis of the trochanter is quite rare, and that when found, it should receive surgical intervention before the sinus stage has been reached.

**Results of Institutional Treatment in Surgical Tuberculosis.** E. D. TELFORD, Manchester, Eng. *The British Medical Journal*, July 2, 1921.

The figures given in this article refer solely to the child crippled by tuberculosis, and embody the results obtained by me from work done at the Manchester Residential Schools for Crippled Children over the period 1905-18.

A careful investigation was made into the after-history of 159 cases which have been traced and examined. All the children dealt with in this report were discharged from the schools not less than three years ago.

#### RESULTS IN 159 CASES.

	Alive and Well	Alive but Disease still Present	Died
Tuberculous disease of spine.	34	10	26
Tuberculous disease of hip..	38	5	9
Tuberculous disease of knee.	28	1	2
Tuberculous disease of foot.	6	0	0
	106	16	37

The cause of death is not known in all the 37 cases. This figure includes two instances of death by accident, and there would, of course, be a certain mortality due to causes other than tuberculosis. Deducting the two cases of accident the number of deaths is 35, and we can obtain from the figures the following definite result:

Out of 100 children between the ages of 5 and 16 years, treated under good conditions for tuberculous disease of the spine and lower extremities, 68 will be cured and able to attend an ordinary school or follow a useful employment; 10 will receive no permanent benefit, and 22 will die from the disease or its sequelae.

The very grave nature of tuberculous disease of the spine is well shown by the figures; of 70 patients with it no fewer than 26 are dead. The mortality is much less for disease of the hip; 9 out of 52. The knee shows only 2 out of 31. The 6 cases of disease of the ankle and foot recovered completely.

The development of abscess is always of grave omen, and it is interesting to note that of the 35 cases who died no fewer than 29 showed evidence of abscess formation on admission to the schools.

The results given above are not so favorable as others which have been published, particularly by more favored institutions in the South of England. It would appear that the further north one goes the more virulent does surgical tuberculosis become—for which the more adverse climate and absence of sun are no doubt mainly responsible.

A point of very real importance is the length of time needed for the treatment of these cases, since this bears directly on the cost and number of beds required in any suggested scheme. The average time is certainly longer than is commonly supposed or usually indicated in the textbooks. In Telford's own cases of surgical tuberculosis of the spine and lower extremity the average duration of in-patient treatment is three years and two months.

**Non-Operative Treatment of Fractures of Cervical Vertebrae With Cord Injury.** The Result in Four Cases. MICHAEL OSNATO, New York, N. Y. *Journal of the A. M. A.*, June 18, 1921.

These four cases gave a mortality of 25 per cent, with undoubted cord injuries. From the neurologic findings the first case was probably a complete crush of the cervical cord, and resulted, as all of these cases do, in death within a few months after the injury. The other three cases were examples of partial involvement of the cervical cord, and all three of the patients recovered without operation.

**A Case of Gynatresia with Pregnancy.** (Ein Fall von Gynatresia hymenalis mit Gravidität). A. GROSS, *Zentralblatt für Gynäkologie*, August 6, 1921.

A three months' pregnancy was noted in spite of complete hymenial occlusion. The menstrual blood had escaped from, and the sperma gained access to, the vagina by a narrow passage in the anterior vaginal wall. This passage terminated in the lower wall of the urethra external to the vesical sphincter.

**Induction of Labor by Means of Rupture of the Membranes and Exhibition of Quinine.** (Mit Eihautstich kombinierte Chinindarreichung zur Einleitung der Geburt bzw. der Frühgeburt). ALBERT FÜLÖP, *Zentralblatt für Gynäkologie*, August 6, 1921.

Bougies, bags and other methods increase the danger of infection. In 15 cases Fülöp was able promptly to bring on labor which lasted on the average only 24.9 hours. Under aseptic precautions the membranes were ruptured with a bullet forceps. Two hours later 7.5 grains, in 25 per cent. solution of chinin bihydrochloricum were given intravenously and a similar dose intramuscularly. If the pains decrease another intramuscular injection may be given. The method should be reserved for cephalic presentations.

## Book Reviews

**Operative Surgery.** By J. SHELTON HORSLEY, M.D., F.A.C.S., Attending Surgeon, St. Elizabeth's Hospital, Richmond, Va. Imperial octavo; 721 pages; 613 illustrations. St Louis: C. V. MOSBY COMPANY, 1921.

Surgeons are gradually coming to recognize that the mere anatomic restoration of a diseased area of the body does not always insure either a renewal of the old normal physiology or a new symptomless one. More and more energy is being expended towards the arrangement of our operative technic with this in view. Therefore any book in which particular stress is laid upon the preservation of physiologic function is of value. Other phenomena which we are learning to appreciate are the biologic processes that follow surgical operations in the transition towards cure.

Horsley's work is of value from both of these points of view.

It is not, as its title might lead one to suppose, a complete reference work on operative surgery. It does cover, however, a wide range of general surgical operations, regionally considered, and well described. Much space, proportionately, is devoted to vascular surgery, a field in which the author's various publications have evinced his especial interest. In the chapter on Blood Transfusion he describes the meth-



ods of vessel anastomosis by Crile's canula and by suture (Horsley's technic). Both, of these, vastly important as they were some years ago in establishing blood transfusion in surgical therapy, are now of merely historic interest. Surgeons (and physicians) today use, in preference, the far simpler and surer semi-direct method of Unger (to which Horsley makes no reference) or the still simpler indirect, "citrate," method of Lewisohn. Horsley himself says he is now using Bernheim's canula method "almost exclusively".

It would be easy, indeed, to find faults in a work which, admittedly, is not intended to be complete. For example, Horsley describes the removal of hemorrhoids by clamp and cautery and by ligation, but—except in the Whitehead operation—not by suture, which, in the opinion of the reviewer, is the best method.

Authors are frequently referred to, but the literary reference is supplied only occasionally. The illustrations, well-executed half-tone and line drawings, are numerous and very helpful.

The student, or the graduate, would make a mistake to purchase this book as his sole reference work on operative surgery. For supplemental reading, however, and as the exposition of the experience of a thoughtful and competent surgeon, he will find it interesting and stimulating.

**Infections of the Hand.** A Guide to the Surgical Treatment of Acute and Chronic Suppurative Processes in the Fingers, Hand and Forearm. By ALLEN B. KANAVEL, M.D., Assistant Professor of Surgery, Northwestern University Medical School; Attending Surgeon, Wesley and Cook County Hospitals, Chicago. *Fourth Edition.* Octavo; 500 pages; 185 illustrations. Philadelphia and New York: LEA & FEBIGER, 1921.

Kanavel's classic on Infections of the Hand, based as it is on painstaking anatomical studies and experiments and on careful clinical observations, took its place as the standard reference work upon that subject when the first edition appeared several years ago. It has maintained that place since then.

In this, the fourth, edition there has been added a chapter of 28 pages on physio-therapeutic measures in The Restoration of Function in Infections of the Hand, and the section on Gas-bacillus Infection has been re-written in the light of knowledge acquired in the recent war. There are other revisions, e. g., in the section on Anthrax and in the discussion of staphylococcus and streptococcus infections, which, though not extensive nor very important, are sufficiently scattered through the text to indicate that it was carefully gone over before re-printing.

Than the hand, there is no part of the body where, in proportion to its regional extent, infection can be so disastrous to form and function; no part that is as commonly the seat of infection; no part in which the management of a suppurative process more thoroughly tests the surgeon's experience, knowledge and judgment. Familiarity with Kanavel's teachings should be part of the equipment of every general surgeon. His book belongs in the library of every surgeon who reads English.

## Books Received

**The Fundamentals of Bacteriology.** By CHARLES BRADFIELD MORREY, B.A., M.D., Professor of Bacteriology and Head of the Department in the Ohio State University, Columbus, Ohio. *Second Edition.* Duodecimo; 320 pages; 177 illustrations. Philadelphia and New York: LEA & FEBIGER, 1921.

**Leitfaden für den Geburtshilflichen Operationskurs.** Von Dr. med. et art. obs. h. c. ALBERT DÖDERLEIN, Geheimer Hofrat, o. ö. Professor der Geburtshilfe und Gynäkologie und Direktor der Universitäts-Frauenklinik in München. *XIII Auflage.* Duodecimo; 272 seiten; 172 abbildungen. Leipzig: GEORG THIEME, 1921.

**The Diagnosis and Treatment of Intussusception.** By CHARLES P. B. CLUBBE, L.R.C.P., M.R.C.S., Consulting Surgeon to the Royal Prince Alfred Hospital; Consulting Surgeon to the Coast Hospital, Sydney; Hon. Surgeon to the Royal Alexandra Hospital for Children; Late Lecturer in Clinical Surgery, University of Sydney, New South Wales. *Second Edition.* Small octavo; 91 pages. London: HENRY FROWDE; HODDER & STOUGHTON, 1921.

**A Physical Interpretation of Shock, Exhaustion, and Restoration.** An Extension of the Kinetic Theory. By GEORGE W. CRILE, M.D., Senior Consultant in Surgical Research, A.E.F., 1917-1918; Professor of Surgery, School of Medicine, Western Reserve University; Visiting Surgeon to the Lakeside Hospital, Cleveland, Ohio. Edited by AMY F. ROWLAND, B.S. Imperial octavo; 232 pages; illustrated. London: HENRY FROWDE; HODDER & STOUGHTON, 1921.

**Graphic Methods in Heart Disease.** By JOHN HAY, M.D., F.R.C.P., Honorary Physician, Liverpool Royal Infirmary; Honorary Consulting Physician, Ministry of Pensions; Late Consulting Physician in Diseases of the Heart (Western Command). With an Introduction by SIR JAMES MACKENZIE, M.D., F.R.C.P. Octavo; 178 pages; illustrated. London: HENRY FROWDE, Oxford University Press; HODDER & STOUGHTON, 1921.

**The Science of Ourselves,** (A Sequel to the "Descent of Man"). By SIR BAMPFYLDE FULLER, K.C.S.I., C.I.E., Author of "Studies of Indian Life and Sentiment", "The Empire of India", "Life and Human Nature", and Other Works. Octavo; 326 pages. London: HENRY FROWDE, Oxford University Press; HODDER & STOUGHTON, 1921.

**Surgical Aspects of Dysentery, Including Liver Abscess.** By ZACHARY COPE, B.A., M.D., M.S., London. F.R.C.S. Eng.; Surgeon to Out-Patients, St. Mary's Hospital; Surgeon to the Bolingbroke Hospital; Capt. R.A.M.C., T. F.; Surgical Specialist with Mesopotamian Exped. Force, 1916-1919; Hunterian Professor, R. A. S. Octavo; 157 pages illustrated. London: HENRY FROWDE; HODDER & STOUGHTON, 1920.

**Gynecology.** By BROOKE M. ANSPACH, M.D., Associate in Gynecology, University of Pennsylvania. With an Introduction by JOHN G. CLARK. Royal Octavo; 752 pages; 526 illustrations. Philadelphia and London: J. B. LIPPINCOTT COMPANY, 1921.

**Studies in Deficiency Disease.** By ROBERT MCGARRISON, M.D., D.Sc., Hon. LL.D. (Belf.), Fellow of the Royal College of Physicians, London; Lauréat de l'Académie de Médecine, Paris; Honorary Surgeon to the Viceroy of India; Lieutenant-Colonel, Indian Medical Service. Imperial octavo; 270 pages; illustrated. London: HENRY FROWDE; HODDER & STOUGHTON, 1921.

**The Oxford Medicine.** By Various Authors. Edited by HENRY A. CHRISTIAN, A.M., M.D., Hersey Professor of the Theory and Practice of Physic, Harvard University; Physician-in-Chief to the Peter Bent Brigham Hospital, Boston, Mass., and SIR JAMES MACKENZIE, M.D., F.R.C.P., LL.D., F.R.S., Consulting Physician to the London Hospital, and Director of the Clinical Institute, St. Andrews, Scotland. In Six Volumes. *Volume IV. Diseases of the Lymphatic Tissue, Metabolism, Locomotory Apparatus, Industrial Disease and Infectious Diseases.* Imperial octavo; 938 pages; illustrated. New York, London, Toronto, Melbourne, Bombay: OXFORD UNIVERSITY PRESS, 1921.

**Prosthetic Dentistry.** A Text-Book on the Chair-side Work for Producing Plate Dentures. By DOUGLAS GABELL, L.R.C.P., M.R.C.S., L.D.S., Dental Surgeon to the Royal Dental and Charing Cross Hospitals; Lecturer on Dental Mechanics to the University of London at the Royal Dental Hospital. Duodecimo; 237 pages; illustrated. London: HENRY FROWDE; HODDER & STOUGHTON, 1921.



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### October      CONTENTS OF THIS ISSUE      1921

AIR CONTROL AS A MEANS OF REDUCING THE POSTOPERATIVE DEATH RATE	Ellsworth Huntington New Haven, Conn.	98
CHARTING THE SIGNS AND SYMPTOMS OF ANESTHESIA FOR TEACHING PURPOSES	A. E. Peebles Wilmington, Ohio	100
EFFECTS OF ANESTHETICS ON THE CELLS	J. F. McClendon Minneapolis, Minn.	104
REMOVAL OF TONSILS AND ADENOIDS UNDER NITROUS OXID-OXYGEN-ANESTHOL-PARALDEHYDE ANESTHESIA	A. Graham Biddle New York City	105
RELATIONS OF SURGEON AND ANESTHETIST	Frank Lahey Boston, Mass.	107
FURTHER STUDIES IN DETERMINING OXYGEN NEED DURING ANESTHESIA	W. I. Jones Columbus, Ohio	109
THE THERAPEUTIC USE OF OXYGEN IN RELATION TO ANOXEMIA	Robert Dawson Rudolf Toronto, Canada	114
PRELIMINARY REPORT OF AN INVESTIGATION INTO THE OXYGEN PERCENTAGES OF NITROUS OXID-OXYGEN ANESTHESIA	Dorothy A. Wood and Mary E. Botsford San Francisco, Cal.	117
SOME OBSERVATIONS ON THE OCCURRENCE OF ACIDOSIS FOLLOWING OPERATION	Edith McKay Ross Winnipeg, Canada	121

### DEPARTMENTS

EDITORIALS	124	SOCIETY PROCEEDINGS	126
BOOK REVIEWS	127	QUARTERLY INDEX	128



## AIR CONTROL AS A MEANS OF REDUCING THE POSTOPERATIVE DEATH RATE.\*

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(Continued from the July Issue.)

Before leaving this subject a word may be added as to the careful investigations of the New York State Ventilation Commission. The Commission is inclined to question the importance of water vapor. Their results, however, are open to question partly because in most instances the number of subjects was small and the duration of the experimental periods only a third or even a quarter of the entire day, and partly because the Commission did not deal with the conditions which our researches seem to indicate as the most favorable. For example, in one very carefully controlled experiment 43 school children were divided into groups of approximately equal size. One group was kept in a room where the relative humidity averaged 28.7 per cent. and the other in a room where it averaged 42.22, the mean temperature in both cases being about 67° F. At the end of four months the experimenters could detect no mental advantage in the group kept in the moister room. In *World Power and Evolution* I have shown that the original records which the chairman of the Commission courteously placed in my hands indicate that during the last month of the experiment the dry room had the disadvantage of being 2.1° warmer than the moister room, but had the compensating advantage of being 54 per cent. more variable. From Table IX it appears that there is an additional reason for not expecting any appreciable mental difference because of the humidity added in the experiment. A relative humidity of 28.7 at 67° corresponds to 2.08 grains of water vapor per cubic foot of air, while a humidity of 42.2 corresponds to 3.05 grains.

When the slight irregularities in the deaths per day in Table IX are eliminated the last column of that table may be taken as representing the normal effect of variations in atmospheric vapor upon postoperative cases in Boston. The difference between the death rates with a vapor content of 2.08 and 3.05 amounts to only 0.018 according to Table IX, or only 5 per cent. of the minimum value found with a vapor content of 6. But the children were in school only

about 6 hours a day for five days a week, and their stay in school was probably broken into four periods by recesses. Even if we disregard the recesses, the children were subjected to the humidified conditions only about 18 per cent. of the time, while during the other 82 per cent. they were subjected to the same conditions as were the children in the non-humidified room. Hence the maximum effect that could be looked for from the experiments of the Commission is less than one per cent., that is 18 per cent. of 5 per cent. Such an amount is well below the probable error arising from the method of experimentation. The Commission rightly concludes that the amount of humidification which they attempted cannot be expected to have any appreciable effect on the work of school children. This is incontestable. There is danger, however, that this conclusion will be misunderstood, and as it has been widely quoted it seems necessary to explain its real significance.

It is not enough to know the best conditions of atmospheric moisture merely at the time of the operation. Accordingly Table X is an attempt to determine this for the day of death, provided the death occurs more than two days after the operation. Unfortunately the records are kept in such a way that it has been possible to use only 573 deaths at the Boston City Hospital during a period of five years. The number of deaths is so small that the figures are somewhat erratic. When compared with the departure of the water vapor from the optimum they give a correlation coefficient of 10.44 but as this is only three times the probable error it does not prove a relationship. It will be noticed, however, that the lowest death rate 0.218, occurred when the vapor content of the atmosphere was 3.6 to 4.0 grains per cubic foot of air. If we compare the departure from this with the death rate we obtain a correlation coefficient of 40.72. Since this is 9 times the probable error, it points strongly to the conclusion that while 5 or more grains of water per cubic foot of air is most beneficial immediately after an operation, the patient within a few days is benefited by having only about 3.5 or 4 grains. I do not stress this since the data are less reliable than in the preceding case, but the large correlative coefficients lead me to believe that the matter is more important than it first seemed probable.

The importance of variability of temperature is still problematic. Yet the data given in this paper seem to show that it deserves most serious consideration. Postoperative deaths agree with other evidence in this respect, as appears in Table XI.

\*Read during the Sixth Annual Meeting of the Interstate Association of Anesthetists in Joint Session with the National Anesthesia Research Society, William Penn Hotel, Pittsburgh, October 5-7, 1920. Awarded one of the second prizes by the N. A. R. S. for meritorious research.



TABLE X. DAILY POSTOPERATIVE DEATHS IN BOSTON CITY HOSPITAL COMPARED WITH THE VAPOR CONTENT OF THE ATMOSPHERE AT 8 A. M. THE DAY OF DEATH.

Vapor Content in Grains per Cubic Foot of Air.	Number of Days.	Number of Deaths.	Deaths Per Day.
0.0-0.5	42	20	0.477
0.6-1.0	179	73	0.408
1.1-1.5	234	84	0.359
1.6-2.0	137	56	0.408
2.1-2.5	224	59	0.264
2.6-3.0	102	33	0.324
3.1-3.5	108	30	0.278
3.6-4.0	115	25	0.218
4.1-4.5	117	35	0.300
4.6-5.0	60	24	0.400
5.1-5.5	97	32	0.330
5.6-6.0	77	28	0.364
6.1-6.5	98	23	0.235
6.6-7.5	54	21	0.388
7.6-8.5	48	26	0.541

TABLE XI. DEATHS PER DAY AT INTERVAL OF 1 TO 10 DAYS AFTER OPERATIONS AT BOSTON CITY HOSPITAL COMPARED WITH CHANGE OF TEMPERATURE FROM 8 A. M. OF DAY OF OPERATION TO 8 A. M. OF SUCCEEDING DAY.

(Figures in parentheses denote number of days.)

	Drop of 9° or more	Drop of 4°-8°	Change of 3° or less	Rise of 4°-8°	Rise of 9° or more
Dec., Jan., Feb...	0.376 (101)	0.365 (52)	0.326 (95)	0.315 (73)	0.303 (99)
Mar.-Nov. ....	0.198 (126)	0.232 (203)	0.343 (586)	0.331 (266)	0.292 (123)

In the three winter months a drop in temperature does harm and a rise is beneficial. This is the opposite of what we found for 400,000 deaths in general in New York City, but there is no real contradiction. We have seen that the harmful effect of a rise of temperature in winter is probably largely due to overheating, although in pneumonia this does not occur so that a rise is beneficial just as with operations. We have also seen that at the time of operations atmospheric moisture is particularly desirable. But a drop in temperature in winter is usually accompanied not merely by a diminution in atmospheric moisture proportional to the decline in temperature, but also by a decline in relative humidity. Thus the slight benefit which accrues to a surgical patient from the small drop in temperature which is allowed to penetrate to his room is more than offset by the increased dryness. During the rest of the year both a drop and a rise of temperature are beneficial, and the drop does more good than the rise, just as in pneumonia. Thus variability appears to have a decided advantage over uniformity as appears from the following figures showing the daily deaths, from March to November inclusive, following operations performed on days with the indicated change of temperature: change of 9° or more in either direction,

0.245 deaths; change of 4° to 8° in either direction, 0.288 deaths; change of less than three degrees, 0.343 deaths.

Turning now from the immediate day of the operation to the day of death, provided that is delayed two days or more, a surprising reversal is found during the winter, while at other seasons the conditions are probably the same as on the day of the operation. This is shown in Table XII. The data for December, January, and February indicate that deaths are fewest with a marked drop in temperature, and increase steadily as the drop diminishes or as it gives place to a rise. This seems to mean that whereas on the day of the operation atmospheric moisture is of primary importance, on later days surgical patients react as do the general mass of patients typified by our 400,000 deaths in New York. For the rest of the year, March to November, the figures are puzzling and inconclusive because of the high figure for a drop of 9° or more. Otherwise the data for the day of death during this part of the year agree with those for the day of operation, and indicate that a drop is favorable, and a rise the same to a smaller degree.

TABLE XII. DEATHS PER DAY AFTER OPERATIONS AT BOSTON CITY HOSPITAL COMPARED WITH CHANGES OF TEMPERATURE ON DAY OF DEATH.

(Figures in parentheses denote number of days.)

	Drop of 9° or more	Drop of 4°-8°	Change of 3° or less	Rise of 4°-8°	Rise of 9° or more
Dec., Jan. Feb...	0.277 (101)	0.307 (52)	0.347 (95)	0.383 (73)	0.404 (99)
March to Nov...	0.428 (126)	0.266 (203)	0.331 (586)	0.309 (266)	0.301 (123)

#### CONCLUSIONS.

Viewed as a whole the effect of temperature, humidity, and variability upon surgical patients appears to agree in principle with the effect upon healthy persons engaged in ordinary work, and with the effect upon patients suffering from diseases in general, or from a particular disease such as pneumonia. Yet there is enough difference in detail to indicate that each type of ailment needs to be studied independently. While pneumonia cases may possibly be a little less sensitive to a moderately high temperature than are many other types, surgical cases immediately after the operation seem to be particularly sensitive to dryness. Further research will doubtless disclose many more such peculiarities in respect to special types of cases. The data at present available merely sketch the broad outlines which future work must fill up. One of the most important things to be done immediately is to determine whether the apparent



effect of atmospheric moisture is wholly a direct effect, or is partly indirect. It is well known that atmospheric moisture is closely connected with atmospheric electricity. It is also known that electrical conditions have a great effect upon health. Stone\* has shown that very slight electrical changes have a pronounced effect in stimulating bacterial reproduction. The bacteria thus stimulated may be harmful or beneficial, and a similar stimulus may be exerted upon the cells of the body. It is also possible that part of the effect of atmospheric moisture may lie in its tendency to clear the air of dust. This is certainly the case under ordinary conditions out-of-doors and to a less extent indoors. In hospitals, however, it is presumably less important because much greater attention is paid to the purity of the air. It needs, none the less, to be investigated more fully.

Pending these further investigations it is possible to state in general terms the atmospheric conditions which are indicated by our data as most favorable in surgical cases. The temperature of the operating room and of the ward to which the patient is first taken should be approximately 66°, the relative humidity should be about 80 per cent. corresponding to a vapor content of 5.5 grains, and the wet bulb thermometer after being fanned a minute or two should read 62°. A temperature of 66° sounds low for an operation where the body of the patient must be exposed. The high humidity makes up for this. Evaporation is largely the cause of the feeling of coolness when the body is exposed to the air. With a relative humidity of 80 per cent. the evaporation will be so slight that the patient will feel as warm as when the thermometer stands at 75° with the ordinary winter dryness of the indoor air in the northern United States. The absence of evaporation will be soothing to the lungs, the mucous membranes, and the nerves. It will also prevent evaporation from the freshly cut surfaces which presumably is harmful.

A few hours after the operation the temperature should be allowed to drop two or three degrees and the atmospheric moisture should be reduced to about 5 grains. Then the dry thermometer will stand at about 63° and the wet thermometer at 59°, provided it is properly fanned. This condition should not last, but should soon give place to a slow rise which may go as far as 68°. No more moisture need be added, and the wet bulb will stand at 61°. After staying at this level two or three hours

the temperature may again be reduced to 63° with the dry bulb at 59°, and then raised as before. This variation should go on until the patient recovers, but gradually the variations should be greater so that at night the thermometer will fall to perhaps 58° with the wet bulb at 54°, while the vapor content of the air may be reduced to about 4 grains per cubic foot, giving a relative humidity of about 60 per cent. at a temperature of 65°. The details of these changes will doubtless vary with different cases. The suggestions here given are as yet largely theoretical, and there is great and immediate need of a long series of exact experiments in many hospitals. Judging by thousands of operations, however, and by millions of deaths from other causes, the general principle of relatively low temperature, high percentage of atmospheric moisture, and frequent mild variations of temperature seems to be sound.

#### CHARTING THE SIGNS AND SYMPTOMS OF ANESTHESIA FOR TEACHING PURPOSES.\*

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It is a great pleasure and an unusual privilege to present a paper before such an audience as this, composed of men and women who are scientific as well as practical and untiring workers in behalf of so worthy a cause as advancing the specialty of anesthesia.

My subject might better have read charting *some* of the signs and symptoms of anesthesia for teaching purposes. It is impossible to have all of the signs and symptoms charted in a *graphic* manner. Where it is possible to demonstrate certain signs and symptoms to the students' minds in a graphic way, I find that their importance and utility are more quickly impressed upon their memory, and it makes the work of the students and the teaching of the instructor much easier and far more positive.

Nothing impresses students of any subject more than something they can see. In teaching anesthesia it is not always possible to have the students see as many patients anesthetized as frequently as may be necessary to impress upon them the signs and symptoms of anesthesia as they are present in each stage of anesthesia.

#### ADVANTAGES OF CHART TEACHING.

In my work, which consists in greater part of teaching anesthesia, I find it quite an advantage to have a graphic chart at hand, upon which is pictured














\*Stone, Geo. E.; Influence of Electricity on Micro-organisms: *Bot. Gaz.*, Vol. 48, 1919, pp. 359-379.

\*Read during the Joint Meeting of the Canadian, Interstate and New York Anesthetists with the Ontario Medical Association, Hotel Clifton, Niagara Falls, Canada, June 1-3, 1921.



# PEEBLES GRAPHIC ANESTHESIA CHART

Systematizing Technic of Administration, and Classifying Symptoms of Patient in the Various Stages of Anesthesia.

Compiled By <b>Dr. E. A. Peebles</b> Wilmington, Ohio <small>Copyrights Valuable Suggestions by Doctors E. L. Wesson and A. E. Guedel...</small>			1 <sup>st</sup> or Partial STAGE	2 <sup>nd</sup> or Excitable STAGE	3 <sup>rd</sup> or SURGICAL STAGE <u>Surgical Strata</u> <small>1<sup>st</sup> Stratum      2<sup>nd</sup> Stratum      3<sup>rd</sup> Stratum</small>			4 <sup>th</sup> or Danger STAGE	
<u>Technic of Administration</u>									
<u>Induction</u>	Normals	Going Down ---	A <sup>o</sup>	N <sub>2</sub> O	N <sub>2</sub> O	N <sub>2</sub> O	N <sub>2</sub> O	N <sub>2</sub> O + O	
		Coming Back ---				N <sub>2</sub> O + O <small>92% 87% Smooth Anesthesia</small>	N <sub>2</sub> O + O <small>90% 10%</small>	N <sub>2</sub> O + O <small>73% 25%</small>	
Abnormals	Anemics --- Plethorics ---	A <sup>o</sup>	Oxygen during Induction, and More in Every Stage Less Oxygen in Every Stage						
<u>Corrective</u>		B					Increase Oxygen	Inflate Lungs One or More Times With Oxygen	
<u>Symptoms</u>									
<u>Respiration</u> - Going Down		C <sup>o</sup>							
<u>Respiration</u> - Coming Back		C <sup>o</sup>							
			Sometimes Phonation	Smooth	Anesthesia	Sometimes Phonation			
<u>Color</u> { Anemics Normals Plethorics		D							
<u>Pupil</u> <u>With Morphine</u>		E							Gradual Dilation----
			Slight Reflexes	Slight Reflexes					
<u>Pupil</u> <u>Without Morphine</u>		E							Insensitive to Light
			Reflexes	Subject to Reflexes					
<u>Eyeball</u>		F	Normal	Rather Active	Oscillating 	Slowly Rolls or Fixed	Fixed or Eccentric	Fixed Sometimes Jerks	
<u>Eyelid</u>		G	Normal	Resistant	Relaxed	Relaxed	Often Open		
<u>Muscular Indications</u>		H	Normal	Rigid	Moderately Relaxed	Relaxed	Relaxed	Spasmodic Contraction	
<u>Larynx</u>		I	Normal	Tendency to Nausea 	Swallowing	Normal	 Tendency to Vomit		
<u>Facial Expression</u>		J	Normal	Consciousness	Normal Sleep	Normal Sleep	Normal Sleep	Bewildered Lids Open	
<u>Temperature</u> <u>Pulse</u> --- N <sub>2</sub> O		K		No Change	No Change	or Slight Fall	Fall		
				No Change	No Change	or Slight Rise	Rise		
<u>Temperature</u> <u>Pulse</u> --- Ether		L			Marked Well	Fall Marked Rise			



not only the changes which take place as regards respiration, color, pupil and eyeball in each stage, of anesthesia, but also showing in the sub-division under the heading of each stage the muscular conditions which usually prevail when the narcosis reaches each particular stratum.

You may tell students over and over again, about the changes displayed by the organs and structures mentioned, and you may go into detailed explanation and after you are through find that they have not absorbed much of what you have said. However, after explaining with *chalk talks*, or by means of a *graphic chart*, students usually retain most of what you are teaching, or immediately refer to the chart and ask questions until they have the signs of greatest importance indelibly impressed upon their minds.

You may tell your class that the respiration is not as uniform in rhythm in the second stage and the last stratum of the third; you may tell them that the pupil will be dilated in these two stages of anesthesia; and that the second stratum of the third stage will be characterized by a comparatively small pupil; you may explain to the students the color as they will see it in various stages, in the three types of patients—anemics, normals and plethorics,—but how many will retain this an hour after being told? Usually the more students are told in the beginning the more they become confused.

Using the chart, I first explain the technic of administration; telling the students the different methods to pursue to arrive at the state of maintenance; and I impress upon them the fact that there is no set rule of proportions of the two gases to use in every case; but that they must have some basis upon which to calculate the proportions necessary for the particular patient, in inducing and maintaining smooth anesthesia.

Then I take each subdivision on the chart showing the students what they may expect to find as regards the respiration, and color in the three types of patients, progressively changing in each stage of anesthesia; then the pupillary contraction and dilation, movements of the eyeball, tonicity of the muscles controlling the movements of the lid, and other muscular changes as the patient merges from one stage of anesthesia to the other.

Of the greatest importance in the administration of nitrous oxid-oxygen anesthesia, I show the students *when to use oxygen, and in what quantities to use it in an emergency for resuscitation*. Some men, who oppose nurse anesthetists, have nurse assistants in their offices assisting in the administrat-

tion of anesthetics; they permit these nurses to give gas-oxygen without having them instructed or without trying to teach them the fundamental principals of anesthesia. If they wish to take a stand against nursing anesthesia they should discard nurse assistants altogether or teach them properly; for many lives are lost by just such carelessness if the nurse knows only enough to stand at the chair and hold the inhaler and has not been taught the *signs of anesthesia*, she cannot be of any help in any emergency that may arise.

As you all know there are a great many refinements in the administration of anesthetics which come to us with each day's experience, and which are almost impossible to acquire in any other way.

To acquire these I would suggest to students the well-known slogan—

*Observe, Compare, Reflect, Record.*

*No one should claim the title of anesthetist or be permitted legally to administer anesthetics, regardless of his degree, until he has proven himself thoroughly conversant with the proper technic which should be used in the different types of patients; and also the symptoms of anesthesia as may be determined by closely watching the respiration, pupil, eyeball, color, muscular indications, facial expression and other signs.*

*Before one may expect to become proficient in this most interesting of specialties, and one of the most important and valuable in the saving of lives, he should study assiduously every organ in the body which has in any way a bearing upon the subject.*

#### TECHNIC OF ADMINISTRATION—NORMALS.

For induction, most successful anesthetists advise carrying the patient through the first and second stages without delay, on account of frequent annoyances which may be encountered by permitting him to linger in the excitable stage.

After reaching the third or surgical stage, which I have divided into three strata, if it were possible to hold the patient in the second stratum and keep him smoothly anesthetized through the entire operation, this would suffice but it is impossible to keep a smooth narcosis for more than a few minutes, unless saturation has been obtained, which may only be accomplished by carrying the patient to the third stratum of the third stage and by immediately adding oxygen, he will return to the first or second stratum of this stage. It may be necessary to repeat this procedure two or three times before perfect relaxation may be obtained.

You will notice by the chart that no oxygen is necessary for induction with normal patients. How-



ever some prominent anesthetists do use a small percentage of oxygen for induction in all types of patients and seem to get very good results; but it seems that the method suggested here is practical, and is more apt to prevent the unpleasant features of the second or excitable stage.

As soon as it is necessary to add oxygen to the nitrous oxid to bring the patient back to the second stratum of the third stage, we should endeavor to determine the proportions of the two gases which are going to keep the patient in the smoothest state of anesthesia.

Having determined the proportions of the two gases, which produce the ideal state of anesthesia, it is essential that the mask be held very close to the face, thus avoiding the entrance of air, which if permitted to enter will dilute and change the mixture, thus preventing a smooth narcosis. In dental operations place a large piece of gauze well back in the mouth to prevent dilution of the gases with air. This should not be done until the patient is pretty well anesthetized.

#### ANEMICS.

During the induction period with anemic patient, it is always necessary to administer from five to twenty-five and in very unusual cases as much as fifty per cent. of oxygen with the nitrous oxid to have the patient's respiration and other symptoms favorable.

#### PLETHORICS.

In the plethoric type of patient a very small amount of oxygen is needed. It is impossible to maintain a satisfactory state of anesthesia with the usual percentage of oxygen. When it is necessary to add oxygen to the mixture for this type of patient it should be added very slowly or they will return to the excitable stage and be difficult to manage, or to the first stage and be awake.

#### SYMPTOMS—RESPIRATION.

In gas-oxygen anesthesia, character of the respiration is of greater importance than that of pupil, eyeball or color.

Usually when the respiration is unfavorable, we will find by referring to the pupil and eyeball that the former is dilated and the latter has become fixed.

We almost invariably find prolonged exhalations when anesthesia has reached the third stratum of the third stage, or when nearing the danger stage. At this time always increase the oxygen. If there should be a cessation of breathing inflate lungs with oxygen, or force oxygen long enough to be sure there is a slight respiration and adjust the apparatus so that the patient will be receiving a small percentage more of oxygen than when the tendency to merge into too

deep anesthesia began and continue with the anesthetic as though nothing had happened and usually the symptoms of the patient will be more favorable than if he had not been carried so deeply.

*At all times keep the chin well elevated; at no time should it be permitted to rest upon the neck, as this position has a tendency to close the air passage and the symptoms will almost immediately be dangerous, causing, if continued a short time, paralysis of the respiratory centers.*

#### COLOR.

While color is a symptom in anesthesia to which we frequently refer, it is dangerous to depend upon it to the exclusion of respiration and the pupil.

If we depend upon color in anemic patients we are sure to be misled, because this type of patients as you will see by the chart has but little color when in the third stratum of the third or the fourth stage.

If the blood of all patients contained the same amount of hemoglobin we would be safer in referring to the color as a guide to the depth of anesthesia.

The color as shown on the chart for the three types, will serve as a basis to study the color and assist with the other symptoms in determining the stage of anesthesia in which we are carrying our patients.

#### PUPIL.

The pupil in the first two stages indicates by its reflexes that anesthesia has not reached the surgical stage. When the reflexes disappear and the pupil grows somewhat smaller, we are carrying our patient in the first stratum of the third stage. Then we will notice the pupil growing still smaller, this indicates the second stratum of the third stage, the most preferable of all stages for operation.

If we continue to anesthetize the patient more deeply, the pupil progressively dilates until in the fourth stage the iris is almost concealed by the marked pupillary dilation.

#### EYEBALL.

The eyeball remains normal and has every movement of a normal condition until we reach the surgical stage; at which time it will oscillate either from side to side or up and down. In the second stratum of this stage the eyeball becomes less active and slowly rolls.

In the third stratum it remains fixed and usually has a centric position.

In the fourth stage the eyeball occasionally jerks prompted by the spasmodic contraction of the muscles, which is characteristic of this stage.



## EYELID.

Under this heading the chart is self-explanatory.

Instead of raising the lid and touching the conjunctiva to determine the depth of anesthesia, merely touch the eyelashes, if the patient has passed through the excitable stage there will be no shrinking of the eyelid from the sense of touch.

## MUSCULAR INDICATIONS.

There are two stages, the excitable or second stage and the danger or fourth stage where we very frequently encounter rigidity.

The question naturally arises in the mind of the student; how are we to know when the muscles become rigid whether it is the second or fourth stage indication? Refer to the pupil and note the respiration; if the pupil is subject to reflexes, the respiration is fairly deep, and the color is good, add nitrous oxid; the patient will pass out of the excitable stage into the third stage and the rigidity will disappear.

If the pupil is dilated and not subject to reflexes, and the respiration shallow or uneven or both, add oxygen to the mixture or give pure oxygen for a very short time; and the rigidity will disappear as the patient returns to lighter anesthesia.

## LARYNX.

When you notice an exaggerated movement of the larynx, accompanied with an effort to swallow, the patient is nauseated, and if there is anything in the stomach will vomit unless immediately changed from this stage of anesthesia. If this condition should prevail when the patient is in the second stage; carry him slightly deeper by adding nitrous oxid to the mixture. If it should occur when the patient is rather deeply anesthetized add oxygen and bring him back into lighter anesthesia; usually the condition is speedily overcome.

## NITROUS OXID-OXYGEN COMPARED WITH ETHER.

The last two subdivisions on the chart represent the slight deviation of pulse and temperature from normal in nitrous oxid and oxygen as compared with ether anesthesia.

Further explanation of the chart will be cheerfully made if requested.

THE MASTER MINDS OF THE WORLD HAVE CO-OPERATED IN PROVIDING YOU WITH THE BEST IN YOUR SPECIALTY IN THE CURRENT EDITION OF THE AMERICAN YEAR-BOOK OF ANESTHESIA AND ANALGESIA. GO INTO THE STUDIES OF THE MOST SUCCESSFUL ANESTHETISTS AND YOU WILL FIND THEM SOLVING THEIR PROBLEMS WITH THE LATEST INFORMATION IN THE YEAR-BOOK. ITS MASTERY WILL ALSO ENABLE YOU TO GIVE EXCEPTIONAL SERVICE.

## EFFECTS OF ANESTHETICS ON THE CELLS.\*

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For many years it was claimed by Verworn and his followers that anesthesia is asphyxiation. He probably came to this conclusion because, during anesthesia of higher animals, muscular movements are inhibited and hence the increased respiration due to muscular movements is prevented. His conclusion has been disputed by many workers who have made experiments on cells or excised tissues. The experiments to show the effect of anesthetics on the cells, however, have been made more or less dubious by difficulties in technic.

## SELECTIVE REACTION OF DIFFERENT CELLS TO ANESTHETICS AND RESPIRATION.

It seems worth while therefore, to consider new experiments in which new ways were found to avoid technical difficulties. In regard to the effects of anesthetics on cells, there are perhaps different types of cells in regard to respiration and which would probably react differently toward anesthetics. Some cells are killed outright by asphyxiation, others produce carbon dioxide in the absence of oxygen and others suspend activity in the absence of oxygen and yet may live for many hours in this dormant state. In performing the following experiments, Grace Medes Professor of Physiology at Vassar, and myself chose different types of cells. I chose cells of the marine jelly-fish, *Cassiopea*, which, in the absence of oxygen live in an inactive state for 7 hours or more, and spring instantly into activity on the admission of oxygen. These cells are not affected by ether. Ether in very high concentration will kill them; but in such concentration as abolishes nerve and muscular activity of the jelly fish ether does not depress the respiration of the resting cells.

If electric stimuli were applied so that the muscle cells were caused to contract the respiration would be raised and ether by abolishing the response to the stimuli would lower respiration, but if stimuli are not applied ether has no effect on respiration. Carbon dioxide, however, depresses respiration. This is not due to the acidity of carbonic acid because other acids have no such effect.

Professor Medes used the cells of the plant, *Clodea*. She found that ether and other anesthetics excited the cells. If the anesthetic was used in very high concentration, however, the cells were killed and

\*Read by proxy during the Ninth Annual Meeting of the American Association of Anesthetists, Hotel Bellevue, Boston, Mass., June 6-8, 1921.



respiration finally stopped. It seemed, however, that carbon dioxid was eliminated for some time after the death of the cells. As a criterion for death or permanent injury of the cells irreversible changes were taken. That is to say, if the cell did not recover after removal of the anesthetic it was considered dead or permanently injured. Some of these irreversible changes were changes that might be reversible with the smaller dose of anesthetic, but became irreversible with the overdose of the anesthetic. They were plasmolysis and cessation of protoplasmic rotation and photosynthesis.

EFFECTS OF ALCOHOL, ETHER, CHLOROFORM AND  
CHLOROTONE ON PLASMOLYSIS, PROTOPLASMIC  
ROTATION AND PHOTOSYNTHESIS.

The effects of alcohol, ether, chloroform and chlorotone were similar, except that the toxic doses varied. Although respiration in the dark was increased by anesthetics, photosynthesis in sunlight was decreased by anesthetics. These anesthetics caused a shrinking of the chloroplasts or bodies in the cells containing the chlorophyll. The greater the shrinkage of the chloroplasts the greater the depression of photosynthesis. In other words, the chloroplast seemed to function in direct ratio with its size. *All these anesthetics caused a diffusion of salts from the cells. In fact, when the cells were placed in distilled water and their normal diffusion rate measured, the anesthetic could increase this rate ten times the normal before permanent injury resulted. If the diffusion was greater than this the cells were killed. It is interesting to note that anesthetics may abolish certain functions of the cells and not others and also that the effect on the functioning of the cells may be accompanied by structural changes in the cells. Whether substances will enter the cells more rapidly as the effect of these anesthetics, was not determined, but the fact that substances leave the cells more rapidly when anesthetized indicates one of the dangers of an overdose of anesthetic since the cell cannot live after loss of all of any substance contained within it.*

IF YOU HAVE NOT AVAILED YOURSELF OF THE OPPORTUNITY OF SECURING THE SECOND VOLUME OF THE AMERICAN YEAR-BOOK OF ANESTHESIA AND ANALGESIA IT WILL BE TO YOUR ADVANTAGE TO DO SO AT ONCE, AS THE EDITION IS BEING RAPIDLY EXHAUSTED. SEND YOUR ORDER AND CHECK FOR IT NOW TO THE SURGERY PUBLISHING CO., 15 EAST 26TH ST., NEW YORK CITY, AND PUT YOURSELF IN TOUCH WITH THE PROGRESS IN YOUR SPECIALTY THAT WILL ENABLE YOU TO PURSUE IT PROFITABLY.

REMOVAL OF TONSILS AND ADENOIDS  
UNDER NITROUS OXID-OXYGEN  
ANESTHOL-PARALDEHYDE  
ANESTHESIA.\*

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This paper is presented with the idea that perhaps the point of view of the surgeon on this subject might prove interesting to the anesthetist.

Anesthesia with nitrous oxid-oxygen combined with anesthol and paraldehyde is very efficient in tonsil and adenoid operations. The usual method now employed by most surgeons of giving ether to complete saturation of the patient is unnecessary for the majority of cases. To secure the same relaxation, and yet avoid the nausea and vomiting which accompanies ether anesthesia, is a goal which is more nearly reached by the method to be described, than by any other. Many times a surgeon goes about his duties serene in the confidence that he has performed a brilliant tonsil operation, while his patient lies in the hospital completely knocked-out by the ether.

METHODS OF TONSILLECTOMY.

There are but two ways of removing tonsils, considered from the standpoint of the anesthetist. One is the *quick* method and the other the *slow*. Simply because it has taken a long time to remove a tonsil, does not of itself indicate that the operation was better performed. The essential features in every tonsil operation are, (1) to remove both tonsils completely, not leaving a piece behind, and (2) to do this with a minimum of hemorrhage and without injury to the surrounding structures. Whether this is done in one minute or in one hour is immaterial so far as the actual results of the operation go. The time element remains for the individual surgeon to decide according to his judgment, skill, and ability.

THE NITROUS OXID-OXYGEN-ANESTHOL METHOD OF  
ANESTHESIA.

My attention was recently called to the work of a prominent dentist in this city, who has performed many thousands of operations without any fatalities, (M. Ecker: Synergistic Anesthesia, *American Journal of Surgery, Anesthesia Supplement*, April, 1921). I have since personally visited Dr. Ecker's office and studied with care his method of anesthesia as applied to dentistry, and I am now using practically the same technic of anesthesia in my tonsil and adenoid operations. Dr. Ecker takes old and young alike, goiter

\*Read during the Meeting of the New York Society of Anesthetists, Academy of Medicine, May 2, 1921.



cases, weak and anemic individuals, just as they drop in from the street, and puts them under and keeps them under as long as required, and when he is through, he permits them to come to; they sit up and go off smiling, almost always without any signs of sickness.

This method as applied to nose and throat cases is essentially as follows:—The regulation Gwathmey sight-feed gas-oxygen apparatus is employed. This is made with two extra attachments, one to contain anesthol and paraldehyde, and the second to contain ether. By a simple turn of a lever, the gases may be made to pass over or through the anesthol container. The ether container is the oil cup arrangement which permits the ether to drop at any desired rate into the hollow tube through which the gases are passing. This is rarely used.

Nitrous oxid-oxygen is considered ideal by most every surgeon as a preliminary anesthetic, but of slight value when it comes to operations requiring the mouth to be open. The difficulty lies in securing sufficient relaxation. The addition of anesthol and paraldehyde gives the relaxation desired..

#### CONSIDERATIONS REGARDING ANESTHOL.

Anesthol, is a mixture of 17 per cent. ethyl chlorid, 35.89 per cent. chloroform, and 47.10 per cent. ether. This mixture is the result of the idea that it might be well to employ an anesthetic whose boiling point lies at the temperature of the body. For if the boiling point is lower (as with ether) the vapor will expand, oppose a greater pressure to the excretion of carbon dioxid, and induce asphyxia. If, on the other hand, the boiling point lies above the body temperature, some of the vapor will be condensed, the excreted air will contain less than the inhaled air, and there will be danger from the drug as with chloroform. The main advantages of ethyl chlorid consists in the rapidity with which anesthesia is induced, in the consequent absence of struggling, excitement and unpleasant sensations, in the very prompt and complete recovery, and the minimum of after-effects. The depressant action of chloroform in anesthol is counter-balanced by the stimulating action of the ether. Anesthol has a boiling point of 40° C. and is claimed to be a stable chemical compound, the composition of which does not change on evaporation.

Paraldehyde is an efficient hyponotic, dulling the psychic centers, and also diminishing the tendency to nausea. Combined with anesthol, the resulting anesthesia is more smooth and there is less tendency to vomiting than when anesthol is used *alone*.

After trying almost every tonsil instrument manufactured, the one, that now enables me to operate most quickly and to the best advantage, is the Van Osdel modification of the LaForce. This little instrument is simplicity itself; its entire manipulation is done with one hand; there are no screws to handle, and one can perform a very rapid operation with very and one can perform a very rapid operation with very slight bleeding.

#### THE OPERATION AND ANESTHETIC PROCEDURE.

Before beginning the anesthetic, have all the instruments sterilized and on the table in the order in which they are to be used. The inhaler which I use is one designed by Dr. Ecker. It fits over the nose only, and has a very small breathing bag. Start the gas-oxygen and allow it to flow for about twenty seconds, the more slowly the anesthetic is given, the longer it will last. About 8 per cent. of oxygen more or less is given. Fixed percentages mean very little. Simply keep the gas bag distended and the patient will take what is needed. Now turn on the anesthol and paraldehyde, equal parts, about two drachms of each having been placed in the anesthol container. The odor of paraldehyde is soon detected about the mask. The rate of flow of gas is kept about the same. In about one minute or more there is a relaxation of the muscles, shown by testing the eye reflexes and opening the mouth. The color of the patient has not changed. There is no cyanosis. There has been no struggling. The patient is not even held down by straps or assistants.

While the mixture is flowing, insert the mouth gag and take out the tonsils and adenoids. After you have finished, shut off the gas, and in a few moments the patient will sit up, step off the table, and go to the room unassisted.

Nausea and vomiting after an ether anesthetic is caused by the ether plus the blood swallowed. Lung abscess is presumably caused by aspiration of blood and mucous into the lungs while the patient is excessively relaxed with ether. The recovery from gas-oxygen-anesthol-paraldehyde anesthesia is so rapid that no blood and mucus is swallowed or aspirated, and lung complications and other untoward by-effects are happily avoided.

Thus also the fear and dread of having the tonsils removed has for a great part been eliminated, and the majority of the patients proclaim it a not unpleasant experience.

17 EAST 42ND ST.



## RELATIONS OF SURGEON AND ANESTHETIST.\*

FRANK LAHEY, M.D.  
BOSTON, MASS.*Members of The American Association of Anesthetists:—*

I wish to extend to you our cordial welcome on your visit to Boston, which has had the good fortune to play so considerable a part in making possible the existence of your specialty and Association.

I shall not attempt to sketch historically the career and experience of that young dentist, whose daring and enthusiasm not only made it possible to accomplish painless surgery, but also laid the foundation for almost the entire progress of surgery since October 16, 1846. To do this would be but a repetition of facts with which you are all undoubtedly very familiar.

Speaking therefore, rather as a surgeon, operating with a small organized group, of which the anesthetist represents no small part, I am going to present to you a few conceptions as to the anesthetist from the operator's practical point of view in such a group.

I have no purpose in presenting these few ideas to you except that of practical utility as they are related to our daily routine surgery of endeavoring to accomplish the greatest degree of relief with the least degree of risk.

DEPENDENCE OF MODERN SURGERY ON ANESTHESIA  
AND THE ANESTHETIST.

We surgeons, with our acute interest in surgical problems purely as such, are too prone, I believe, to be forgetful of the fact that this entire wonderful structure of modern surgery, with all its marvelous present and future possibilities, is primarily dependent upon anesthesia for its existence and extension. We should, therefore, be greatly concerned and interested in the anesthetist.

We have in our group become impressed with the need and advantage of the anesthetist's sharing to a considerable degree the clinical responsibility. We feel quite strongly that an anesthetist's opinion as to the type of anesthesia best suited for a given case should be accepted, unless it is contraindicated by limitations as applied to the sort of operation contemplated.

*We feel that the decision as to the extent of an operation should be settled, frequently, in consultation with the anesthetist, and that in those cases, in which a narrow margin of safety exists, even though*

*the extent of the operation has been determined previously, it will be of advantage again to review the situation with the anesthetist, when the patient is upon the table and in the condition under which he must endure the operation.. We are quite sure that this has at times modified our views regarding the extent of an operation with the result that lesser procedures, utilized as preliminary measures, have resulted in the saving of individuals' lives.*

## VALUE OF MULTIPLE-STAGE PROCEDURE.

It is our belief that multiple-stage procedures have been the means of saving many lives otherwise lost under the older system of one-stage procedures, and that many of the lesser preliminary measures may very readily be accomplished by means of anesthetics less dangerous from their effects both upon the general condition and upon those structures associated with alteration and elimination of end-products.

In proof of the danger-diminishing effects of multiple-stage procedures, I have but to recall the value of preliminary cystostomy in prostatic cases of limited kidney capacity; of the advantage of preliminary colostomy of the spur type in complete resection for cancer of the rectum; of the three stage Mikulicz operation in resection of the large intestine; of the distinct improvement in general condition to be accomplished in those gastric lesions requiring resection, if that operation is preceded by a preliminary gastroenterostomy; of the decided lessening of the risk, and at times cures, in acute empyemata, which may be accomplished by means of preliminary catheter drainage; and, in thyroid disease, of the very markedly diminished mortality rate, a part of which, at least, is due to preliminary pole ligation. It is in these preliminary procedures, in the cases which are of uncertain risk, that the consultation and cooperation between operator and anesthetist are very often productive, we believe, in the choice of conservative measures, accomplished often safely with the aid of the refined special anesthetics, such as local, spinal, gas-oxygen, or mild mixtures of gas-oxygen and ether.

RELATIONS OF SURGEON AND ANESTHETIST TO  
RELAXATION.

While we realize that it is not always possible, or perhaps from the point of view of security wise, for an anesthetist, to confine his administration of anesthetics to the practice of one surgeon, we feel sure that much is accomplished to the mutual advantage of all concerned,—patient, surgeon, and anesthetist—if the surgeon and anesthetist are constantly working together. We feel that improper relaxation or over-

\*Address of Welcome presented before the American Association of Anesthetists during the Ninth Annual Meeting, Hotel Bellevue, Boston, Mass., June 6-8, 1921.



etherization, resulting in unnecessary waits during the operation,—both conditions in our opinion detrimental to the patient beyond the mere loss of time involved,—should in an organized operating team be of very infrequent occurrence.

I speak particularly of the matter of relaxation in abdominal cases because I have found that there are apparently varying views as to the desirability of complete and moderate relaxation. We wish to place ourselves in the group who are in favor of early and late deep anesthesia. We believe that the local and general ill-effects of pulling and rough handling, often necessary with a straining patient, more than offset any disadvantages which attach themselves to deep anesthesia during exposure and closure.

We have, for several years, preached to our house officers and assistants that exposure is a very large element in the success of surgery, that many of the immediately irritating complications of an operation are the results of inadequate exposure, and that irrespective of incisions of proper length, the proper placing of pads and the intelligent use of retractors, exposure of the type which makes surgery infinitely safer and simpler is, in our opinion, impossible in most instances without complete relaxation during the time when the lesion or lesions are being sought and brought under direct vision for surgical treatment.

We believe that an acceptance of this assumption by our anesthetist assigns to him the responsibility for its accomplishment, admitting always its difficulties of attainment in certain individual cases. We are further of the opinion that inadequate relaxation, making as it does the operative treatment more trying and troublesome, results unconsciously, at times, in the employment of more limited and less satisfactory surgical measures. In the same way we feel that if all layers of sutures in an abdominal wound can be introduced with the patient's wall in relaxation, there is a more equal distribution of strain upon all layers of tissue and less likelihood of their giving way when each is inserted with that layer of fascia, muscle, or peritoneum under tension.

With these views in mind, therefore, we feel that an anesthetist should familiarize himself with the steps of the operation particularly as they relate to manipulations requiring relaxation and to the approaching time of closure of the abdominal wound. I know of nothing in surgery which provides greater satisfaction than the perfectly relaxed abdomen permitting of complete and thorough exploration, the rapid and efficient exposure of the lesion, expeditious application of surgical treatment, and accurate and secure approximation of the wound edges.

On the other hand, from our point of view we

know of nothing which looks worse or is worse than the straining of a patient whose viscera are endeavoring to perch themselves conspicuously upon the patient's abdomen or to insinuate themselves coyly between the futilely restraining fingers of the often flustered and harassed surgeon.

What can be more convincing as to the need and value of an expert anesthetist than to have that same patient taken over by a competent anesthetist and by the use of proper head posture, airways, relief from obstruction, or conduction of the patient into a proper phase of anesthesia, see him in a short time converted into the desirable operative subject just spoken of?

#### THE ANESTHETIST'S RESPONSIBILITY IN TERMINATING OPERATION.

*In our opinion, there exists no more forceful argument in favor of the regular employment of a trained anesthetist than the fact that once the operation is under way, the responsibility as to whether the patient is going to be able to endure the complete procedure is almost entirely in the hands of the anesthetist. In our experience, this problem not infrequently arises, creating a situation in which it is essential that the experience and judgment of the anesthetist shall be of just as high an order as that of the surgeon when the original decision for or against operation is made. Failure to provide against this always possible emergency places, we believe, the responsibility for events consequent to it directly upon the operator himself.*

*If, then, we accept these facts as sound reasons, we believe that there should be such confidence on the part of the operator in his anesthetist that the operator should not hesitate in accepting his directions as to terminating the operation when once the anesthetist is convinced of the desirability of that measure. We are sure that we have seen fatalities occur which could have been converted into successful outcomes had there existed between the surgeon and anesthetist mutual confidence engendered by long existing co-operative experience.*

*In this connection, it is our custom never to undertake further extensive operative procedures upon a patient, who has already been subjected to a major surgical procedure, without consultation with our anesthetist, making reference to the pulse, respiration, and blood pressure chart, and informing him as to the probable amount of time to be consumed, having in mind always the possible complications which may arise and prolong the estimated period of time.*

*In this decision we believe that both anesthetist and surgeon should completely divorce from their minds any consideration of the patient or the patient's friends' disappointment because of an incomplete operation, or the contemplation of further surgical*



*procedures. We ourselves are uninfluenced by that fallacious argument which we have often heard: That if the entire operation is not done now, the patient will not submit to the later operation. It is our feeling that the responsibility in this matter is entirely the patient's; that his rights primarily demand that he survive the operation, granted that the procedures involved are consistent with sound surgery, and that, this provision being accomplished, it is then his right to decide whether he will or will not undergo the necessary further surgical measures.*

#### CONCLUSION.

In conclusion, I believe that it is the duty of every surgeon, to facilitate, in every possible way, the advancement of your branch of specialization and to aid by every possible measure the further development of this Association, since it directly results in the scientific advancement of surgery itself and the distinct diminution of the operative risk to the individual.

#### FURTHER STUDIES IN DETERMINING OXYGEN NEED DURING ANESTHESIA.\*

W. I. JONES, D.D.S.,  
COLUMBUS, OHIO.

It is held by some that 90 per cent. of all patients, who undergo anesthesia for dental and surgical operations, may be classed as standardized risks—or in other words they can be considered as from *fair* to *good* risks. So much so that their reception of an anesthetic can be rather definitely forecast and the induction, especially of nitrous oxid-oxygen can be standardized for all practical purposes.

In even the remaining 10 per cent, anesthesia can be induced and maintained more or less routinely in a standardized way and the recovery period will, in all probability, be uneventful.

#### INCREASE OF HAZARDOUS RISKS.

From my experience in many thousands of cases I am led to believe that hazardous risks were formerly the exception, especially in dentistry and oral surgery, but that recent advances have materially broadened the field of the operator and the anesthetist and have introduced the necessity of handling a far greater proportion of *poor* risks.

At the present time even the average exodontist meets, days in and out, with patients who are anything but proper or safe risks under anesthetics, general or local, and it is, therefore, important and necessary that some way should be established for

picking out such patients rapidly and accurately.

*Because fatalities still occur with undiminished regularity in the chair and on the table it is indeed important to discover, if possible, some routine method of obviating such fatalities as are at least preventable. The fact that deaths occur in the hands of even the most expert anesthetists would indicate that the conditions of patients has now become a prime factor in determining the risk involved in the operative procedure and in instituting safety-first precautions in anesthesia.*

It can no longer be maintained either that because patients are too bad risks for general that they can be handled under local anesthesia with absolute safety. The later method is now providing its full quota of fatalities, particularly in the operations of dentistry and the specialties and its use demands the self-same precautionary safety-first evaluation of patients' conditions as general anesthesia.

Nowadays it is not unusual for the dental operator to encounter patients with goiter, tuberculosis, heart and kidney diseases, respiratory complications and varying degrees of sepsis, anemia and toxemia. It is, therefore, necessary to formulate a routine plan by means of which to determine not only the fitness of these patients to take an anesthetic, but more especially to determine also in advance how anesthesia may be given with the greatest safety to the bad risks encountered.

Before proceeding to the diagnostic phase of this subject it will be of interest to review certain researches regarding the relation of oxygen need to anesthesia and its further relation to the pathological conditions of poor risks.

#### RELATIVE VIABILITY OF THE RESPIRATORY AND CARDIAC SYSTEMS UNDER NITROUS OXID-OXYGEN ANESTHESIA.

The writer and Prof. McPeck, of the Department of Physiology, the Medical College of the Ohio State University, during the past few years have been conducting a number of experiments on animals for the purpose of determining the relative viability of the respiratory and cardiac systems under anesthesia especially nitrous oxid-oxygen. Several theories have been advanced as to the way in which nitrous oxid produces anesthesia.

Nitrous oxid outside the body supports combustion, while in the tissues, other than the central nervous system, it acts like any other indifferent gas. Animals die when placed in it, seeds will not germinate in it, or plants grow, and the blood of an animal killed by it contains no oxyhemoglobin.

\*Read during the Joint Meeting of the Canadian, Interstate and New York Anesthetists with the Ontario Medical Association, Hotel Clifton, Niagara Falls, Canada, June 1-3, 1921.



Nitrous oxid has a special effect on the central nervous system by reason of its excluding oxygen. If it were an indifferent gas, no effects should be obtained with a four-to-one mixture because ordi-

It is introduced by way of the respiratory tract into the lungs, when it is distributed throughout the alveoli of this organ where it is taken up by the blood, but upon which it has no specific chemical ef-



Fig. 1. Prof. McPeck and Dr. Jones in the Laboratory of the Ohio State University experimenting on oxygen need in anesthesia. The method of experimentation and apparatus being herewith shown.

nary atmospheric air is four parts of nitrogen and one part of oxygen.

Blood dissolves more nitrous oxid than water, apparently for the reason that it is taken up by the lipoids of the corpuscles in much the same way that chloroform is.

fect, the resultant anesthesia being produced by some alteration of the oxygenating processes in the human body. *This sub-oxygenating process beginning back in the pulmonary circulation where, owing to the supply of oxygen being cut off, the venous blood of the artery passes unchanged into the minute radicles of*



the pulmonary veins, causing more or less stagnation, which results in a general anoxic condition that may quickly develop into asphyxiation, unless much skill is used in the proper mixing of the gases, and a much closer watch kept over the respiration, pulse and color of the patient than is necessary when using ether.

The fact that nitrous oxid anesthesia can sometimes be produced without any apparent or easily discovered cyanosis, does not prove that anesthesia is not the result of a diminished or altered supply of oxygen, because, in fact, it is the increasing or di-

alyzing affect upon the respiratory center. Of this we are convinced by large clinical experience of many thousands of administrations for all sorts of surgical operations, and more recently by laboratory experiments.

Our object was to determine which was the first to succumb to the use of nitrous oxid when used to a lethal degree. In all of our experiments the same phenomena were present in every case, *viz.*, when surgical anesthesia was produced and maintained, a beautifully rhythmical pulse and respiration were the result, but when oxygen was shut off and nitrous

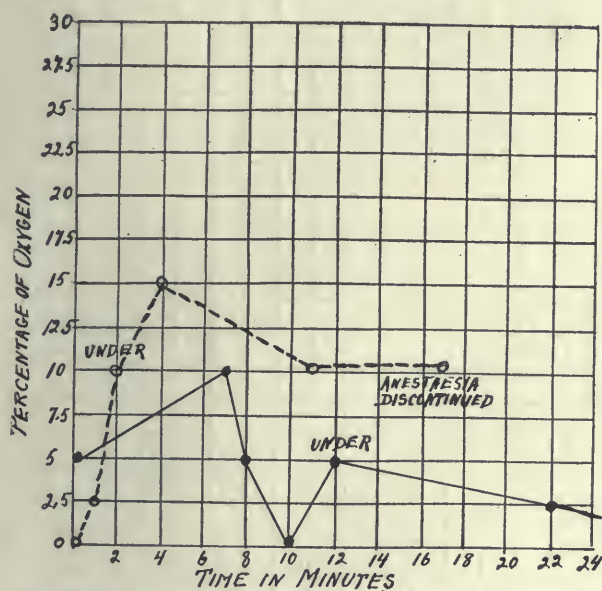


Chart A. Weight of pig 540 grams. Estimated blood content 41 cc. (1-13 of body weight). Amount of blood withdrawn 8 cc. (20 per cent.). Oxygen requirement before exsanguination 6.5 per cent., after 12.3 per cent. Solid line represents oxygen need before and dotted line after exsanguination, in all charts.

minishing of the oxygen which determines the depth of the anesthesia, and profound anesthesia is frequently obtained especially in the very anemic, or those with a low hemoglobin test, without the slightest apparent sign of cyanosis being present—so that those of limited experience may easily be mistaken in reading the signs of anesthesia. In other words, nitrous oxid anesthesia is a general anoxic condition, whether cyanosis is present or not, in which the brain cells partake of the general anoxemia, thus preventing the recording of pain sensations, because the brain cells, like the pulmonary veins, only functionate in the presence of oxygen. If we had asphyxia to a lethal degree, there would be a total cessation of all the processes of life.

Nitrous oxid when given to a lethal degree does not produce death by paralyzing the heart muscle, as has been stated by some surgeons, but by its par-

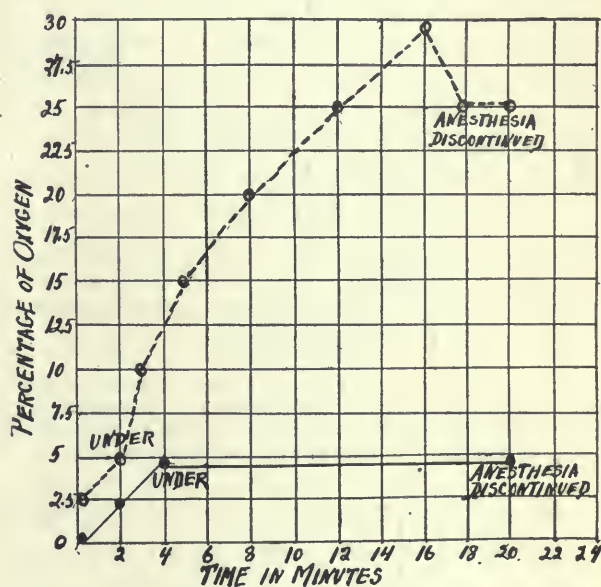


Chart B. Weight of pig 500 grams. Estimated blood content 37 grams (1-13 of body weight). Amount of blood withdrawn 7.5 cc. (20 per cent.). Oxygen requirement before exsanguination 5 per cent., after 18 per cent.

oxid was used for the express purpose of producing the death of the animal, the blood pressure was suddenly increased, the respiration became more rapid and finally death ensued from asphyxia. In one case the heart continued to beat for as much as five minutes and forty-five seconds after the last gasp of respiration. Inasmuch as resuscitation was possible immediately after the cessation of respiration, the conclusion was reached that the viability of the respiratory center was less than that of the cardiac.

Several of the dogs had one or both of the vagus nerves severed; death from a too rich mixture of nitrous oxid showed the same features, although impulses were no longer able to travel over the vagus.

The independent resistant element of the heart muscle to oxygen deprivation must be considered as a favorable feature. According to the experiments of Bert and Martin, death results from a lack of oxygen, rather than to the presence of the nitrous oxid.



# RATIO BETWEEN THE HEMOGLOBIN INDEX AND OXYGEN NEED DURING ANESTHESIA.

Another investigation was conducted by Prof. Mc-Peek and the writer to determine some definite and

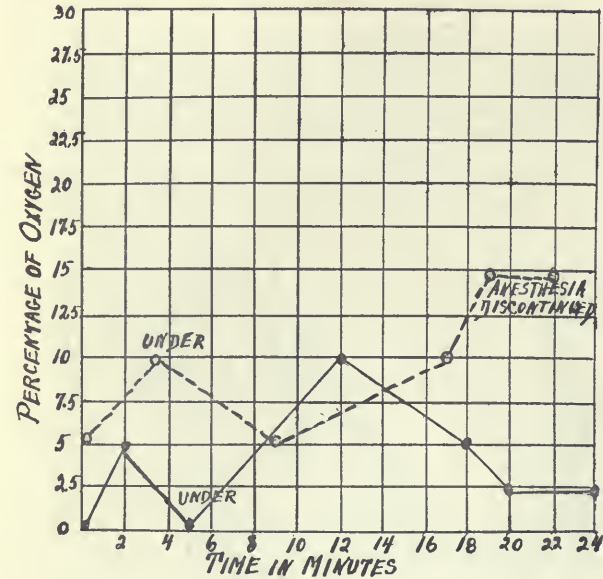


Chart C. Weight of pig 590 grams. Estimated blood content 45 grams (1-13 of body weight). Amount of blood withdrawn 9 cc. (20 per cent.). Oxygen requirement before exsanguination 4.9 per cent., after 9.3 per cent.

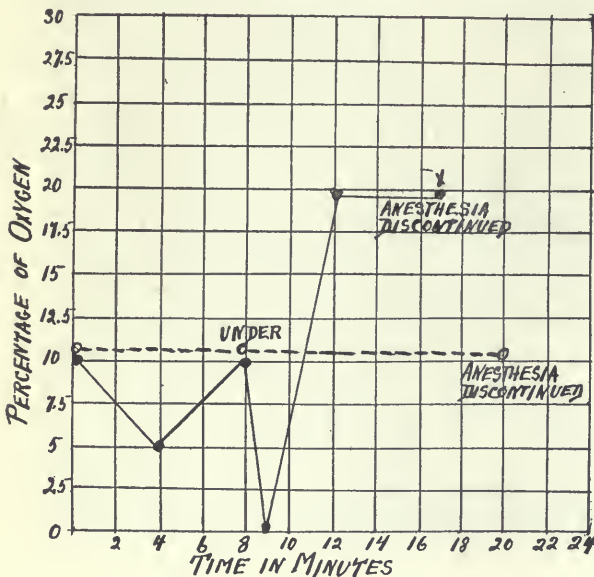


Chart D. Weight of pig 531 grams. Estimated blood content 40 grams (1-13 of body weight). Amount of blood withdrawn 3 cc. (7.5 per cent.). Oxygen requirement 1 to 1. In this case the animal was so young that it was difficult to maintain satisfactory anesthesia.

fixed ratio between the hemoglobin index and the oxygen need during anesthesia and to demonstrate quantitatively as well as qualitatively the amount of oxygen required for safe anesthesia following shock

due to loss of blood. Anesthetists and operators have known for a long time that anemic patients and those who have lost a quantity of blood were poor anesthetic risks, but to our knowledge this has not been determined quantitatively before as to oxygen need with definite percentages of blood loss.

Guinea pigs were used as experimental animals on account of their small size and tractibility. The pigs were confined in a bell jar with oxygen and nitrous oxid flowing through pressure regulating gauges and with a suction apparatus and a mercurial manometer

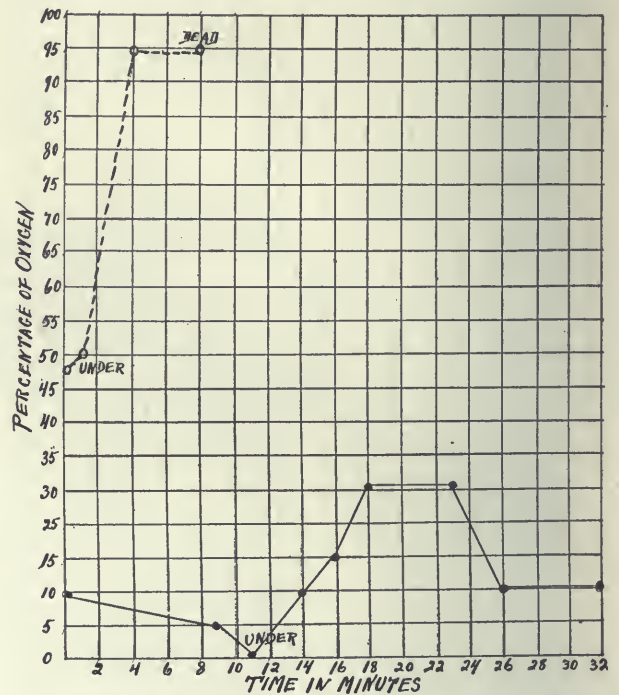


Chart E. Weight of pig 625 grams. Estimated blood content 48 grams (1-13 of body weight). Amount of blood withdrawn 12.5 cc. (25 per cent.). Oxygen requirement before exsanguination 15.5 per cent., after 75.5 per cent.

connected up to prove that circulation of the gases was positive as shown in the accompanying illustration.

In all 15 experiments were performed. The blood was removed from the heart by aspiration and at intervals of from ten minutes to 24 hours afterwards anesthesia was induced and maintained for an average of 15 minutes. From a study of charts, similar to those herewith illustrated, we concluded that where the animals suffered a loss of 20 per cent of its blood content the amount of oxygen required was from two to three times greater than it was before exsanguination and that after 25 per cent loss of blood the ratio was increased until the oxygen requirement was 5 times greater than it had been before.

The results of these experiments bear out those of



W. B. Cannon in the war zone, in which he found that shocked soldiers readily died under anesthesia and that even nitrous oxid-oxygen did not save life unless given with enough oxygen to meet the patient's requirement. Thus in first degree shock Cannon found the oxygen need to be from 20 to 30 per cent; in secondary shock from 30 to 40 per cent, and in third degree shock from 40 per cent upward.

#### OXYGEN LACK AND ACIDOSIS.

It is the factor of oxygen lack that must bear the burden of blame for untoward complications resulting from nitrous oxid-oxygen anesthesia. Oxygen starvation means acidosis and even a slight increase in acid products is dangerous in cases with hemoglobinemia, shock, cachexia or starvation, toxemia, cardio-renal changes, pulmonary lesions and various other conditions of disturbed metabolism, in which there is frequently excess of acid products and consequent tendency to acidosis.

Nearly all these patients may present one or more of the following signs and symptoms:

1. Color changes such as cyanosis or pallor.
2. Hemoglobin deficiency.
3. Changes in the respiratory rhythm as shown by various grades of dyspnea, apnea, with or without cyanosis or anoxemia.
4. Tachycardia or bradycardia.
5. Lowered carbon dioxid tension in the alveolar air and arterial blood.
6. Acetonuria, glycosuria or albuminuria.

In nearly all these conditions the hemoglobin reservoirs are low and the final oxidations of the acid derivatives of metabolism are incomplete. These acid products are poured into the blood stream in excess and the protective mechanism of the human economy is subjected to an abnormal strain. The neutrality of the blood is maintained almost to the end but with ever-increasing difficulty. Lungs and

kidneys are hard pressed to eliminate the acids. Thus in diabetes the carbon dioxid tension is depressed. With dyspnea there is increased formation of acid bodies as shown by the lowered carbon dioxid tension of the alveolar air. When cyanosis or apnea accompanies cardiac conditions there is either oxygen lack or an imbalance of the oxygen-carbon dioxid ratio.

The patients with the cardio-renal changes are among the most serious risks which the anesthetists or dental operator meets. The condition is especially precarious because slight degrees of myocarditis or interstitial nephritis often come to operation unrecognized. These patients demand more than the normal volume of oxygen in their tidal air and slight degrees of asphyxia may fatally increase acidosis or produce a disastrous degree of heart strain. The patient may avoid decompensation at the time, but it may be sudden and fatal after operation. Pulmonary lesions and hemorrhagic conditions are not so serious as they can be more readily influenced and bettered by judicious oxygenation and rebreathing to conserve carbon dioxid stimulation.

#### DIAGNOSING IMPERILLING CONDITIONS.

In making and solving the presenting problems the anesthetist and dental operator has the following diagnostic methods at hand. The history and physical examination bring out certain pathological conditions, while the pulse rate, blood pressures, pulse pressure, heart load, breath holding test and hemoglobin index bring out others. These later when charted serve to fix the attention of the anesthetist and operator especially on oxygen need.

Stange, of Petrograd, considers the condition of the heart as the best indication of the patient's ability to withstand general anesthesia. To determine the condition of the cardiac muscle, Stange recommends the so-called *respiratory test*—that is the

CHART F.

Case No.	Condition	Breath Holding Test	Pulse Rate	Blood Pressure Sys.	Dias.	Pulse Pressure	Hemoglobin Index	Oxygen Per Cent.	Oxygen Increase Per Cent.
1.	Diabetes	16 sec.	108				80		
2.	Thyroid	10 sec.	110	142	95	47	70	6.	50.
3.	Thyroid	10 sec.	150	145	67	78	70	8.	100.
4.		25 sec.	112	123	82	41	70		
5.	Anemia	15 sec.	96	152	74	78	60		
6.	Mitral Regurgitation	40 sec.	92	115	65	50 (Compensating heart)			
7.	Mitral Murmur	14 sec.	110	182	62	120	70		100.
8.	Tuberculosis	12 sec.	110	98	78	20	70		
9.		15 sec.	100	104	104	40	80		
10.	Pus Diabetes	20 sec.	104	120	62	58	70		
11.	5½ per cent Sugar.	35 sec.		(Operation for gangrene)				10.	
12.	Sepsis	12 sec.	94	148	100	48		8.	
	(Bad teeth; large amounts of pus; giant-cell epulis of lower jaw)								
13.	Acute Infective								
	Cellulitis	15 sec.	120	(Temperature 102.4°—For every degree above normal temperature the baso-metabolic rate is increased 10 per cent.)					



ability to abstain from breathing for some time. Healthy persons can do this from 30 to 40 seconds, while those with a weak heart muscle can hold their breath as most from 10 to 20 seconds. The test is very simple. The patient, sitting at ease, takes a deep inspiration and closes the mouth—the nostrils being compressed to avoid involuntary expiration—and while the patient holds the breath as long as possible, the seconds are counted. If there is any doubt as to the exact breath holding capacity of the patient the test may be made more severe by evaluating several breath holdings in succession.

While Stange seems to have had no suspicion that his test was based on an apnea due to acidosis, nevertheless he reported observations on a number of chronic diseases in which he found the duration of voluntary apnea to be abbreviated in about the degree in which acidosis is known to occur from the results of other observers, especially Yandell Henderson. Thus voluntary apnea due to myocardial degeneration or acidosis and diagnosed by this simple respiratory test will serve as a warning to the anesthetist and operator in handling diabetic, cardiac and renal risks.

There are other conditions in which the breath holding capacity is also lowered such as in low or high pulse pressure and decreased hemoglobin index. It has also been found that an increased pulse rate, along with other symptoms may indicate increased metabolism and increased oxygen need.

In conclusion it may also be said from a study of the accompanying tabulation that the anesthetist and dental operator, who will routinely subject all patients to the examination indicated and will chart the figures resulting, will be in a position to make a differential diagnosis of what relation apnea bears to the pathological condition of the patient and what oxygen requirement is needed for safe anesthesia.

237 E. STATE ST.

## THE THERAPEUTIC USE OF OXYGEN IN RELATION TO ANOXEMIA.\*

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The term anoxemia means a want of oxygen in the blood and has been used by Haldane to express *the condition when the rate of supply of oxygen is insufficient for the normal carrying on of life.*

The supply of oxygen to the tissues is a very vital thing. As a leader-writer in the *British Medical Journal* expressed it not long ago, *a man may go for weeks without food, for days without water, but for seconds without oxygen.*

### CAUSES OF ANOXEMIA.

The causes of anoxemia may be grouped under the four following headings:

- (1) Defective charging of the arterial blood with oxygen in the lungs.
- (2) Slowing of the circulation.
- (3) Defective proportion of available hemoglobin in the blood.
- (4) An alteration of the dissociation curve of the oxyhemoglobin so that oxygen is less easily given off than usual.

Most of these causes are quite evident and do not need any elaboration. For example, it is clear that if the partial oxygen pressure in the alvolar air be insufficient the blood and then the tissues will suffer. Such lowering of the partial pressure occurs at high altitudes, or from any interference with the external respiration, as happens in respiratory obstruction or from pneumonia.

When the circulation is slowed from any cause the blood dwells too long in contact with the tissues after it has given up its oxygen and is slow to return to the lungs for recharging. Thus general anoxemia arises in circulatory diseases and local anoxemia from any causes interfering with the local circulation.

When the hemoglobin-content of the blood is low then, although the proportion of oxygen in the inspired air be normal and the external respiration be perfect, still the blood is unable to carry sufficient oxygen to the tissues, as the hemoglobin is the chief carrier of the gas. The red cells are estimated to carry some forty times as much of it as does the plasma.

\*Read during the Joint Meeting of the Canadian, Interstate and New York Anesthetists with the Ontario Medical Association, Hotel Clifton, Niagara Falls, Canada, June 1-3, 1921.

THE TENTH ANNIVERSARY MEETING OF THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL BE HELD AT THE HOTEL JEFFERSON, ST. LOUIS, MAY 22-24, 1922, THE FIRST THREE DAYS OF THE A. M. A. WEEK. LAY YOUR PLANS NOW TO ATTEND THIS MEETING AND MAKE YOUR HOTEL RESERVATIONS AT ONCE. IF YOU HAVE A PAPER ON ANY PERTINENT SUBJECT YOU WISH TO PRESENT, NOTIFY THE SECRETARY AS SOON AS POSSIBLE. ALSO LET THE OFFICERS KNOW IN WHAT WAY THEY CAN MAKE THIS MEETING MORE INSTRUCTIVE AND ENJOYABLE TO YOU.



## DISCUSSION.

All the same, it is the blood plasma which eventually supplies the tissues with oxygen, and if we can only raise the percentage of this gas in it sufficiently it is possible to support life without the presence of any hemoglobin or blood cells. This is shown, by the well-known experiment in which the blood of a frog is completely replaced by normal saline solution and when the animal is placed in an atmosphere of pure oxygen it continues to absorb the normal amount of this gas and to exhale the normal amount of carbon dioxide.

Also it has been found that animals can be kept alive in an oxygen pressure of two atmospheres after their hemoglobin has been completely saturated with carbonic monoxid gas. The carbon monoxid is not toxic in any way and merely usurps all the carrying capacity of the hemoglobin so that there is no room for any oxygen. At an oxygen pressure of two atmospheres, however, enough of the oxygen is carried, dissolved in the blood plasma, to supply the urgent needs of the tissues.

Thus the hemoglobin is merely a convenient carrier of oxygen in small bulk. If there were only plasma in the vessels it would require a volume of 150 kilograms or more to carry the required oxygen from the lungs to the tissues; that is, the contents of the vascular system would weigh twice as much as the body of an average man (Macleod's Physiology, p. 392).

*The alteration of the dissociation curve of the oxyhemoglobin is a less evident cause of anoxemia at first sight. Various factors influence the rate of giving off of the oxygen from the hemoglobin. Thus, the rate is increased by a rise in the carbon dioxide pressure in the blood, by fever and by a rise in the saline contents of the plasma. On the other hand, when the carbonic acid content of the blood is lowered the hemoglobin clings to its oxygen and thus the tissues may be starved of this, even although the hemoglobin in their vicinity holds much of it.*

The relation of anoxemia to cyanosis is very close. One may say that any individual who shows signs of cyanosis from anoxemia, but, on the other hand, it is possible for him to be a victim of local anoxemia without any appearance of cyanosis, and, further, general anoxemia may exist in the absence of cyanosis, as is seen in carbon monoxid poisoning, when the patient may be dying from want of oxygen and yet his mucous membranes appear cherry-red. His hemoglobin is carrying carbon monoxid instead of oxygen.

*Nitrous oxid, when inhaled, is carried merely dissolved in the blood plasma and does not combine in any way with the hemoglobin. Hence, unless it is so abundant that it displaces the oxygen in the alveolar air it does not interfere with the intake of oxygen. An atmosphere of 80 per cent of nitrous oxid and 20 per cent of oxygen gives just as much oxygen to the blood as does pure air.*

## OXYGEN NEED.

The atmospheric air contains some twenty per cent of oxygen and this amount is ample for the needs of an individual in health. The blood is practically saturated with it and hence can take up little more when the partial pressure of oxygen in the inspired air is artificially raised. A person may inhale pure oxygen at atmospheric pressure for some time without any noticeable effects. I have tried it for twenty minutes at a time and could detect no subjective sensations nor were the pulse or respiratory rates or the blood pressure affected.

It is known that the proportion of oxygen in the inspired air may be lowered in a healthy person to perhaps 14 per cent without the production of any distress. The six per cent or so above this figure is, as the late Dr. Meltzer termed it, a *factor of safety* for the meeting of emergencies. Thus, although a man can live quietly in an atmosphere containing only 14 per cent of oxygen, let him exert himself and he soon feels the need of the extra 6 per cent. People suffering from any disease interfering with the intake or carrying of oxygen correspond to the healthy individual undergoing exertion and so they need all the oxygen that ordinary air contains.

At great elevations the oxygen pressure is low and thus the factor of safety is absent and persons suffering from pneumonia acutely feel the need and hence such cases do badly at high altitudes.

Again, although the 20 per cent of oxygen in the air is ample for the normal individual even when he is exerting himself considerably it has been shown, by Leonard Hill and others, that he can do a good deal more without distress if he inhale oxygen at a higher pressure than that of the air. *In the same way when a patient with some respiratory trouble is struggling for breath we can raise his factor of safety by increasing the oxygen pressure in the air that he breathes and hence the value of oxygen therapy in such cases.*

## METHOD OF THERAPEUTIC USE.

When oxygen is given by the common method of merely holding a funnel connected with the oxygen tank near the face of the subject it is said to be im-



possible to raise the percentage of the gas in the alveolar air by more than two per cent and professor Macleod and I found this to be the case. *If, however, the oxygen be given through a tube inserted into one nostril the alveolar oxygen can be raised much more than this and if the other nostril be rhythmically closed by an attendant during each inspiration the oxygen in the expired air (i.e. the alveolar oxygen) may reach nearly 50 per cent.* A still better way of administering oxygen is by the Meltzer apparatus. This consists of a hollow tongue depressor which is placed in the patient's mouth and is connected with a gas bag filled from a cylinder. A valve is so placed that during each inspiration the oxygen under pressure from the elastic walls of the bag enters the patient's fauces, while during expiration the oxygen flow is checked and a large opening appears near the valve through which the patient easily exhales. The valve is worked rhythmically by an assistant. By using this mechanism we were able to raise the oxygen in the alveolar air to 86.7 per cent. Lately oxygen has been administered by placing the patient in an oxygen chamber and much may be hoped from this more elaborate method.

*Normally the oxygen in the blood plasma stands about 0.35 per cent., the balance of the gas in the blood being combined with the hemoglobin, but it is possible to raise percentage of oxygen in the plasma very much by increasing the proportion of it in inspired air. Thus, if that in the alveolar air is made to stand at 36.4 per cent. the percentage in the plasma will be at 0.945 and if the alveolar oxygen be at 86.7 per cent. (as it was in our experiment with the Meltzer apparatus) that in the plasma will be at 2.26 per cent. or nearly seven times the normal and thus the tissues will be directly supplied with so much extra oxygen without the intervention of the hemoglobin at all. If the oxygen pressure be raised above that of an atmosphere then still more will be forced into the plasma according to Henry's law.*

Meakins found that the arterial blood in the normal individual was nearly although not quite saturated with oxygen, but that in pneumonia patients it was not nearly so, the *undersaturation* as it is called being as much as 18 per cent. If such patients were given oxygen, by the Haldane method, this undersaturation could be largely caused to disappear, greatly to the relief of the sufferers.

#### EFFECTS OF TOO MUCH AND TOO LITTLE OXYGEN.

It would be beside the mark here to discuss the details of the therapeutic use of oxygen, but one point may be made clear:—*Does the inhalation of*

*pure oxygen cause any damage to the inhaler?*

Much experimental work has been done upon this subject. If mice be kept in an atmosphere of pure oxygen for several days they tend to develop pneumonia, and if the pressure of oxygen be raised to three atmospheres they do so very quickly. But any exposure of them to one atmosphere of pure oxygen for several hours does not produce any deleterious effects and we may conclude that the therapeutic use of oxygen for an hour or so or less at a time will do absolutely no harm.

As already said, the effects of an insufficient supply of oxygen to the tissues is drastic.

The respiratory center is regulated partly by nervous influence but chiefly by chemical changes in it. The chief stimulus here is an increased carbonic acid content of the blood although any increase in the hydrogen ion content of the blood will have a similar effect. The center is, indeed, extremely sensitive to slight changes in the reaction of the blood and this sensitiveness varies, being lowered by some drugs such as morphin and chloral hydrate and probably by certain toxins. Lowering of the oxygen content of the plasma has some effect in stimulating the center and it is believed that the chief cause of Cheyne-Stoke's breathing is this, rather than variations in the carbonic acid content of the blood.

All the same, although a want of oxygen has some effect in stimulating the center, if this want be sufficiently great the center will cease to act from anoxemia and then the administration of oxygen may cause it to act again. The cells of the center like those of all the other tissues of the body require oxygen for the continuance of their life.

It seems very bold for a mere physician who is not an anesthetist to be giving a communication before such an assembly as this, but I will have accomplished my purpose if I have reminded you of the extreme need of the living organism for oxygen and have pointed out some of the dangers of anoxemia.

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THE PACIFIC COAST ASSOCIATION OF ANESTHETISTS WILL MEET WITH THE CALIFORNIA STATE MEDICAL SOCIETY, MAY 15-19, 1922. THE PLACE OF MEETING WILL BE CAMP CURRY, YOSEMITE. MEAN-TIME IF YOU ARE INTERESTED IN MEMBERSHIP OR IN BEING ON THE PROGRAM GET IN TOUCH WITH DR. ELEANOR SEYMOUR, SECRETARY, 1329 SOUTH GRAND AVE., LOS ANGELES. THE ANESTHETIC SECTION OF THE CALIFORNIA STATE MEDICAL SOCIETY WILL MEET AT THE SAME TIME.



# PRELIMINARY REPORT OF AN INVESTIGATION INTO THE OXYGEN PERCENTAGES OF NITROUS OXID-OXYGEN ANESTHESIA.\*

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When nitrous oxid was originally introduced as an anesthetic agent, it was used alone or in combination with air. In 1868 Horace Andrews, of Chicago, first called attention to the fact that nitrous oxid and oxygen was a much more *satisfactory* anesthetic mixture. In order to obtain the anesthetic state, in average individuals, at least 80 per cent. of nitrous oxid in the inspired gas mixture is necessary. This leaves only 20 per cent. to be occupied by other gases, and as the air contains 80 per cent. useless nitrogen and 20 per cent. of oxygen, it follows that in a mixture of nitrous oxid and air the percentages would be 80 per cent nitrous oxid, 16 per cent useless nitrogen and 4 per cent. oxygen. Sometimes 80 per cent. nitrous oxid proves insufficient for relaxation and then the available oxygen must be crowded down to 3 or even 2 per cent. This necessitated very short operative procedures, since at least 10, 15 or 20 per cent. of oxygen is necessary to support life for any length of time. Andrews' suggestion was, therefore, a great step in advance in the use of nitrous oxid anesthesia, for then the mixture became 80 to 90 per cent. nitrous oxid and 20 to 10 per cent. oxygen, and the method became available for continuous use and larger operations.

## RESULTS OF ASPHYXIA AND CYANOSIS.

Many of the accidents and objections to the use of nitrous oxid arise from the bad effects noted from the cyanosis of insufficient oxygenation. It is not necessary to go into a detailed description of asphyxia; suffice it to say that during asphyxia the respiratory and cardiac rates are increased, the blood pressure is elevated, there is deep cyanosis, rigidity of the voluntary muscles, spasmodic jerking movements (jactitation) and dilatation of the pupils. Treatment of asphyxia is the immediate administration of oxygen; for if asphyxia remains untreated death rapidly ensues. However, momentary asphyxial nitrous oxid anesthesia of the type used for very short operations, when oxygen is at hand for re-oxygenation, has been proven to be *comparatively safe*, and it is the prolonged state of *slight cyanosis*

which gives the really damaging results. Morse demonstrates—"a direct relationship between the frequency and severity of postanesthetic vomiting and headaches, with the amount of cyanosis present during the operation. The *duration* of the cyanosis seems to be a more striking factor than the *intensity*, for *transient cyanosis*, though quite marked, was not succeeded by these sequelae, while low grades of *slight duskiness*, *prolonged*, gave evidence of postanesthetic acidosis."

Aside from this is the problem of damage to the heart muscle from an insufficient supply of oxygen.

## SAFE ZONES OF NITROUS OXID ANESTHESIA IN RELATION TO OXYGEN PERCENTAGES.

The question then arises—*What is the percentage of oxygen in the mixture of nitrous oxid and oxygen that it is safe for anesthesia?* A search was made through the literature for statements concerning the *percentage of oxygen need* and these varied from 2 to 20 per cent. of oxygen. However, the calibrations on most machines are incorrect for absolute percentages, so that the wide range of figures cannot be relied on nor the low recorded percentages be wholly condemned. It was not until Karl Connell, by means of the anethetometer, perfected the mechanical difficulties of recording gas delivery that a definite table of nitrous oxid-oxygen percentages, with the results of varying mixtures, could be worked out. He found that any mixture less than 92 per cent. nitrous oxid and 8 per cent. oxygen was extremely dangerous and was useful only for momentary procedures, but even for this its use was condemned. He found the mixture 92 per cent. nitrous oxid and 8 per cent. oxygen satisfactory for *induction only*. The zone recommended for abdominal surgery had the mixture of 89 per cent. nitrous oxid and 11 per cent oxygen, in which zone the color of the patient was faintly cyanotic. The zone for surface surgery was 86 to 84 per cent. of nitrous oxid and 14 to 16 per cent. oxygen, in which the color was normal. This zone, with the addition of a slight amount of ether when necessary, in suitable cases is recommended as best for all work, including abdominal surgery. A mixture of 80 per cent. nitrous oxid and 20 per cent. oxygen gives a subconscious analgesic suitable for obstetrics.

## INDICATIONS FOR INCREASED OXYGEN NEED.

Now various conditions in individual patients arise to upset the minute regulation of gas-oxygen proportions. It was the experience of Marshall and Cannon, in war surgery, that patients operated on

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following severe loss of blood, or during shock, required a much greater percentage of oxygen for operative safety, than did normal subjects. With this as a basis, W. I. Jones and Clayton McPeck, conducted researches on guinea pigs, using nitrous oxid-oxygen anesthesia; and after determining the proper and safe degree of oxygenation in a normal set of pigs, and plotting the gas-oxygen percentage curves, the pigs were exsanguinated to varying degrees and then reanesthetized to determine the new oxygen need. In their preliminary report they state that they then found that the same proportion of gases, safe in normal animals, were dangerous and fatal to those exsanguinated. In fact it was possible to determine by the reaction of the exsanguinated pigs that a blood loss of 20 per cent. demanded 3 to 4 times the amount of oxygen of normal pigs. This, therefore, is a very definite indication for using increased oxygenation with nitrous oxid, in the presence of recent hemorrhage.

Karl Connell had previously stated that any altered capacity of the blood to transfer oxygen, either in decreased rate of blood flow, or diminished hemoglobin content, would upset his charted table of zones, and that persons with reduced hemoglobin, septic conditions, excessive or rapidly increasing weight, and growing children demanded a greater percentage of oxygen in gas-oxygen anesthesia. He stated also that the percentage of oxygen need is approximately in direct ratio to the degree of anemia present and that a patient with a 50 per cent. hemoglobin index requires, for the zone of light anesthesia, 18 to 20 per cent. oxygen instead of 11 per cent. required by a normal individual.

During the war some very interesting investigations were carried on at the Mineola Flying Field, concerning the oxygen need of men who were candidates for the aviation service. The response of the aviator to a decreasing supply of oxygen was tested by experiments lasting from 25 to 145 minutes. Three methods of oxygen variation were employed. *First*—A chamber was constructed in which it was possible to reduce the barometric pressure and thus duplicate the pressures and oxygen tensions of varying heights in the air. *Second*—A rebreathing machine was used, (with stationary barometric pressure of sea level), which started out with ordinary air, but gradually with the rebreathing, the oxygen content was decreased and the carbon dioxide was absorbed with caustic potash. *Third*—Respired air was diluted with increasing amounts of nitrogen. The results obtained from the three methods of

oxygen variation were the same, proving that the barometric pressure of high altitudes is not the causative factor in mountain sickness, but that the difficulties in breathing, rapid pulse rate, headache, cyanosis and syncope are due to the diminished oxygen tensions of high elevations. As the oxygen in the air inhaled from the apparatus was reduced, the man was thereby virtually elevated to a corresponding altitude. Thus a mixture containing 20 per cent. oxygen has a barometric pressure of 760 and the altitude is sea level. When the oxygen percentage is reduced to 17.9 per cent. it equals that of an elevation of 4,000 feet and a barometric pressure of 651. Similarly

Oxygen Percentages	Altitudes	Barometric Pressures
15.9	7,000	579
14.2	10,000	516
13.2	12,000	478
12.2	14,000	444
11.3	16,000	412
10.0	19,000	368
6.4	30,000	230

As the oxygen percentages were decreased almost the same symptoms were noted in these men as are noted by anesthetists when the oxygen content becomes insufficient during anesthesia, that is, an increase in respiratory volume and rate, an increase in pulse rate, an elevation in blood pressure and the appearance of cyanosis. There is headache and nausea and the counterpart of this we have in gas-oxygen anesthesia, as the postanesthetic headache and vomiting noted in cases that have been somewhat cyanosed during the larger part of the anesthesia.

In the aviator tests, some men compensated so easily and so well that they stood, for brief intervals, as low as 6 per cent. oxygen or an altitude of 31,000 feet, which is higher than any heavier-than-air flying machine has ever reached. Other men failed to compensate at all, or did so poorly, and, therefore, could not endure even the slight oxygen deficiency of moderate altitudes.

#### BODILY REACTION TO VARIOUS OXYGEN TENSIONS.

The respiratory and cardiac centers are ordinarily stimulated by about the same fall in oxygen pressure. In some subjects the first response began at an oxygen percentage of 17.9 per cent.; while the majority showed the first response between 15.5 to 16.5 per cent. This, therefore, means that the average individual, when the oxygen content of the inspired mixture becomes less than 15 per cent., must necessarily put out some effort to keep



metabolic processes at the proper level, and it would seem that low-oxygen percentages under anesthesia would be very similar to low-oxygen percentages at high altitudes. We then have the following problem to consider—Is the patient in question, under anesthesia, able to stand the necessary increase in pulse rate, respiratory rate, and blood pressure elevation? Also is this particular patient one of those who would react well in the aviator tests?—For there were three very definite types of reaction to the tests made.

*The optimum type* showed no response until the reduced oxygen reached about 15 per cent., then there was a gradual increase in pulse, respiration and blood pressure until 7 to 6 per cent. oxygen was reached, when the blood pressure, pulse and respiration started to drop and the patients fainted, with rapid recovery following administration of oxygen.

*The second type* showed response at 17.9 per cent. oxygen and the compensatory reactions were excessive, pulse, respirations and blood pressure went very high and collapse came at 9 to 8 per cent. oxygen, with a much longer time required to recover and with severe headache for sometime thereafter.

*A third type* is seen in elderly people, in whom there may be practically no response, no rise in blood pressure, very little rise in pulse rate and respiratory rate. The compensatory mechanism seems to be entirely overwhelmed. The counterpart to this type is seen in patients, who are unable to have ether added to the gas-oxygen mixture for relaxation; these patients may become cyanosed in an effort to keep them relaxed sufficiently for operative work, and then, although there is cyanosis, there may be no change in pulse, respiration and blood pressure. These patients may then show postoperative myocarditis, due to the fact of the insufficient amount of oxygen supplied the heart muscle during the operation.

From the foregoing it can be seen that no person tested was able to stand an oxygen tension of less than 15 per cent. without the occurrence of certain definite compensatory reactions. This might be directly applied to gas-oxygen anesthesia, to the effect that no patient should receive less than 15 per cent. oxygen, unless the condition of his heart allowed him to be placed in the optimum class already mentioned, and that no patient with any symptoms of cardio-respiratory strain should be given less than 18 per cent. oxygen, and that such a patient would be better off if a small amount of ether were given instead for relaxation.

#### OXYGEN PERCENTAGES IN ARTERIAL AND VENOUS BLOOD.

In 1893, some experiments were performed on rabbits and dogs under anesthesia by Oliver and Garrett; blood was taken and tested for the gaseous content. One animal was given pure nitrous oxid without oxygen and blood was withdrawn during deep cyanosis. The analysis showed

	Before inhalation.	After inhalation.
Carbon dioxide	34.3 per cent.	15.66 per cent.
Oxygen	22.0 per cent.	3.49 per cent.
Nitrogen	1.8 per cent.	11.23 per cent.
Nitrous oxid		22.49 per cent.

This experiment was the only one of its type found in a very careful search of the literature.

Lundsgaard, and afterward Stadie, worked out the oxygen percentages in venous and arterial blood in cyanosed and uncyanosed individuals. But to our knowledge no one has worked out these under varying percentages of oxygen intake during anesthesia. Lundsgaard collected venous blood and analyzed it (1) as to its total oxygen combining capacity and (2) for the actual amount of oxygen present in the sample. The difference between the two he termed the oxygen unsaturation. The extent of oxygen unsaturation in venous blood of normal individuals averaged 5.7 cc. of oxygen per 100 cc. of blood. He then examined a series of patients with decompensated hearts, the unsaturation here averaged 12.4 cc. per 100 cc. of blood. With a return to compensation he found the oxygen unsaturation again within normal limits. Stadie found the venous oxygen unsaturation in cyanosed pneumonia patients to be 10.0 cc. of oxygen per 100 cc. of blood. He found that in normal individuals there was an unsaturation of 1.1 cc. of oxygen to 100 cc. of arterial blood and in cyanosed individuals 5.6 cc. of oxygen unsaturation per 100 cc. of arterial blood.

#### AUTHORS EXPERIMENTS.

With this experimental work before us we thought that the same line of investigation could be carried out under anesthesia, with blood oxygen determinations to indicate what the degree of oxygen unsaturation is under varying percentages of oxygen intake.

Our proposed experimental investigation is to anesthetize dogs with nitrous oxid and varying percentages of oxygen, to find the percentage of oxygen which first calls upon the compensatory mechanism of the animal. This will be done by Kymographic records of pulse, respiratory rate and blood pressure.



We will then repeat the experiments using rebreathing, and thus determine what change in oxygen percentage is necessary in the presence of carbon dioxide and to then repeat a third time on exsanguinated dogs to determine the oxygen needs of low hemoglobin. It is proposed to take samples of blood, in all of the three types of experiments, at varying levels of oxygen intake percentages to determine the degree of oxygen unsaturation in the blood under anesthesia, without cyanosis and with slight, moderate and intense cyanosis. The results of these experiments will be reported on later.

## CONCLUSION.

As a matter of practice anesthetists ordinarily use the color of the patient's cheek, forehead and finger nails as the guide to the safety of anesthesia, but Lundsgaard found that a considerable degree of oxygen unsaturation in the blood may be present without showing as cyanosis. He also found that hemoglobin was less than 35 per cent. Thus the color index, unchecked by other tests of the patient's condition is not a safe guide in gas-oxygen anesthesia. Also it would seem that an accurate means of gas delivery with an oxygen percentage seldom less than 15 per cent. is much to be preferred to the more or less haphazard methods of nitrous oxide-oxygen administration usually employed.

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IF YOU HAVE NOT ALREADY MADE YOUR RESERVATIONS AT THE HOTEL MUEHLEBACH FOR THE MID-WESTERN ANESTHETISTS' MEETING, KANSAS CITY, OCTOBER 24-28, 1921, DO SO AT ONCE. A SPLENDID SCIENTIFIC PROGRAM OF PERTINENT PAPERS AND CLINICS HAS BEEN ARRANGED. ALL THOSE INTERESTED IN ANESTHESIA IN THE MIDDLE WEST ARE URGED TO GET IN TOUCH WITH DR. MORRIS H. CLARK, SECRETARY, RIALTO BLDG., KANSAS CITY, TO CONSUMMATE THEIR MEMBERSHIP. THIS IS THE ONE BIG WAY IN WHICH YOU CAN BRING YOUR SPECIALTY INTO ITS OWN.



## SOME OBSERVATIONS ON THE OCCURRENCE OF ACIDOSIS FOLLOWING OPERATION.\*

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The condition termed *acidosis*, exclusive of the acidosis of diabetes, is one of fairly frequent occurrence in surgical practice, if one includes all cases in which there is an actual lessened alkaline reserve in the blood of the patient.

Restricting the use of the term to those cases which show actual clinical symptoms, this condition is fortunately much more rare; but these cases do occur often enough to make the condition one of concern to every practitioner.

### THE CLINICAL PICTURE OF ACIDOSIS.

We may recall briefly the clinical picture presented by these cases, which vary in severity from those showing rather prolonged nausea and vomiting, headache, and slight restlessness, to those cases in which the patient rouses from the anesthetic only to lapse into a rapidly deepening coma, with rising temperature, pulse and respiration rates, and with death supervening within twenty-four to forty-eight hours.

Between these extremes, of course, lie the majority of those cases in which attention is especially attracted to this condition. In these cases, the patients usually vomit excessively, and instead of diminishing the nausea and vomiting increase; the temperature and pulse rate rise; the pulse often alarmingly; and a characteristic type of breathing appears. In this the nostrils are widely dilated, the mouth usually being open too, and the patient seems to be gasping for breath. It seems as though in spite of the fact that there is no obstruction, the patient is not inhaling enough air for his needs, and, in effect, this is just what is happening. There is plenty of air getting into the lungs, but the blood has lost, to a greater or less extent, its power of carrying oxygen, and the patient actually is *air-hungry*.

### ROUTINE EXAMINATION FOR ACIDOSIS.

Some years ago, following what might almost be termed an epidemic of cases, occurring for the most part among out-patient tonsils-cases, we began a routine examination of the urine of all cases coming to operation, and subsequently began to make an additional postoperative urinalysis, from all cases under one of the surgical services. This routine ex-

amination of anteoperative urine included tests for albumen, sugar, acetone and diacetic acid. We made no examinations of the blood of any of these patients, though we became convinced, as our experiments proceeded, that an urinalysis could only be of value in those cases in which elimination parallels formation of acid bodies; and we had no means of knowing whether this was the case in any of our patients. We came to this conclusion when we found that many patients excreted large amounts of acetone and diacetic acid in the urine and had no symptoms; while we occasionally found patients, in whom the toxemia was fairly marked but who excreted little or no acetone or diacetic acid. *We believed that the patients who showed no symptoms except the presence of acid-bodies in the urine, did so because they were excreting practically all the acid-bodies formed, and so did not encroach on their alkaline reserve; while in those cases in which marked symptoms appeared with no corresponding urinary findings, the patients were forming acid-bodies in large amount, and not excreting any.*

### RELATION OF ANESTHESIA AND OPERATION TO ACIDOSIS.

We did not find that the particular anesthetic used made any difference in those cases giving positive results in the urinary tests, although we had no cases of pure chloroform anesthesia in our series. It appeared that the nitrous oxid patients more seldom developed symptoms than others, but their urinalysis results were not appreciably different. We have no record of a case operated under local anesthesia developing marked symptoms, though several vomited, and many gave positive urinary findings following operation.

We did not find that length of operation was a factor in the development of symptoms; on the contrary most of our severe cases were among children operated for removal of tonsils and adenoids, in whom the trauma of operation was comparatively slight, the amount of anesthetic used small, and the length of anesthesia including the induction period, only about ten minutes.

### URINARY FINDINGS.

We found about 22 per cent of our patients with acetone, and 15 per cent with diacetic acid in the urine before operation. Caldwell and Cleveland, of New York in *Surgery, Gynecology and Obstetrics*, July, 1917, state that 23 per cent of their patients had acetone, while 13 per cent had diacetic acid, our figures corresponding fairly closely with these. But while

\*Read during the Joint Meeting of the Canadian, Interstate and New York Anesthetists with the Ontario Medical Association, Hotel Clifton, Niagara Falls, Canada, June 1-3, 1921.



they give figures of 72 and 56 per cent respectively for the acetone and diacetic acid tests in their post-operative examinations, our figures never showed more than 50 per cent with acetone and about 35 per cent with diacetic acid, and these figures only in the earlier period of our experiments. *Later, following the adoption of more liberal feeding before operation, no purgation except an enema the morning of operation, and earlier and more plentiful feeding following operation, these figures were still further reduced.*

#### TYPES OF CASES SHOWING ACIDOSIS.

Of these patients showing acetone and diacetic acid before operation, the large majority were patients who had been ill for some time, some with infections, many of them with the toxemia of pregnancy, with pathological conditions causing varying degrees of starvation, or were children who had not been actually ill, but in whom one could trace the effects of too little food or of some type of malnutrition. Some of the children were apparently healthy, but in these one could not overlook the element of starvation for the twelve or eighteen hours preceding operation.

*On the other hand, practically all the emergency cases, in which the condition calling for operation involved the intestinal tract, with the exception of injuries, showed varying degrees of acidosis clinically, and the almost invariable presence of acid bodies in the urine, and both the degree of reaction in the urine, and the severity of the clinical symptoms appeared in these cases to increase with the length of time the patient had been ill before coming to operation. That is to say, those patients who came to operation within twelve hours of the onset of an attack of appendicitis usually showed no symptoms, and gave slight reactions in their urinalysis, while those patients who came, in from two to three days or later, with abscess formation or peritonitis, usually displayed marked symptoms and gave more marked reactions. Whether this almost constant factor of acidosis in acute abdomens results from the presence of infection, or whether it results from the voluntary starvation of the patient and the vomiting of his illness, we were not able to determine; but we did come to the conclusion that not only did the presence of these bodies in the urine, and the clinical symptoms not contraindicate operation in acute conditions, but on the contrary was an added indication for it, since these cases practically always rapidly improved insofar as the acidosis was concerned, following operation.*

It appeared that women more frequently developed acidosis than men, though this predominance was not marked. But it is certainly true that children were far more susceptible to this condition than adults. So far as adults were concerned, the question of age did not seem to figure, since aged people did not develop it more frequently than those in the prime of life, when one considers also the greater frequency among them of malignant conditions giving rise to starvation.

#### ELIMINATION OF FEAR.

Children especially, but also adults, who exhibited great fear, appeared to develop symptoms of acidosis more often following operation, and this even when there had been no trace of acid bodies in the urine beforehand. We did not know whether this fear was a factor in the subsequent development of acidosis, but rather inclined to the belief that the fear was simply one of the nervous manifestations of a pre-existing acidosis which was not shown in the excretions from the kidneys.

The mental factor in this condition is a very real one, and we have come to the conclusion that more attention given to the night's rest which the patient gets before operation, and more attention paid to the type of induction of anesthesia, would repay us. Bromides are perhaps preferable to morphin the night before operation, and it may be that it would be wise to make this routine treatment for all adults. A dose of morphin suitable to the individual patient, and combined with atropin, should be given from a half to one hour before operation. This and an induction slow and careful enough to eliminate the patient's sense of smothering and danger, and to prevent any actual deprivation of oxygen, and a tactful attempt to "humor him along" till consciousness has left him, certainly seem to us to be factors in the prevention of acidosis, and especially so in those very cases where one has most reason to fear its occurrence.

#### ETHER-OIL COLONIC ANESTHESIA.

In this connection I would like to call your attention to our small series of fifty or sixty cases of ether-oil colonic anesthetics. I cannot say how many of these showed acid-bodies in the urine, but I am able definitely to state that none of them developed clinical symptoms, and this in spite of the fact that the cases themselves were practically all such in which one might reasonably anticipate acidosis as a development. This fact I attribute largely to the almost complete elimination of fear and under-oxygenation in this method of anesthesia.



## VALUE OF OXYGENATION.

*It had been our practice in a large number of cases to add a small, constant stream of oxygen to the anesthetic in use, and our results in these cases were so uniformly good as regards postanesthetic nausea and vomiting that we became convinced that under-oxygenation was an important factor in the production of postanesthetic acidosis. We believe that if to every ether anesthetic there were added sufficient oxygen to prevent the slightest degree of cyanosis, there would be fewer cases of acidosis develop following these anesthetics.*

## SAFEGUARDS.

It has been our experience that the average patient showing acetone and diacetic acid in the urine before operation, but with no clinical symptoms, can be safely operated, though they are to be closely watched and should be treated with soda and glucose in some form, as a routine. We have also found that when the acidosis depends upon the condition requiring operation, as a gastric ulcer, it is fairly safe to operate such patients if there are no clinical symptoms; and if there are, to institute treatment, and carry it on for a few days, and then operate, recommencing the treatment immediately. In the case of children coming for operations for which there is no urgency, such as tonsillectomies, we have followed the practice of deferring operation, and feeding the child with sugars and carbohydrates in any form which he will take, also laying stress on large amounts of water, until the reactions are negative and the child shows no clinical symptoms. *One should repeat that this negative result of an urinalysis is only an approximate indication of the state of the patient's blood, and when there is any doubt the blood should be examined.*

We came to the conclusion that practically all these cases are simply a matter of feeding so far as treatment is concerned. For the prevention of symptoms of acidosis we believe that all cases coming to operation should be well-fed up till the morning of operation; that if operation is to be late in the morning they should have a light breakfast and should have water until within two hours of operation. This of course is not intended to apply to gastric surgery. Purgation is not advised; we found that an enema the morning of operation is usually sufficient. Bromides the night before, and a dose of morphin before operation are advisable, the latter because it does lessen the amount of anesthetic required to some extent, and chiefly because it makes the induction easier for the patient as a rule.

In adults we do not believe that there is necessity for active treatment with sodium bicarbonate as a routine, although any case which gives positive reactions in the urine for acid-bodies, or shows clinical symptoms, should at once be put on treatment.

Following operation the patient is to be encouraged to drink quantities of water as soon as conscious and to eat food as soon as possible. He will probably vomit on his first attempt, but we think he will recover from his postanesthetic nausea the sooner. The diet should be increased to normal as rapidly as possible. If acetone appears in the urine, and especially so if clinical symptoms appear, sodium bicarbonate and glucose are to be given freely, and if the condition becomes alarming some one of the various formulae for intravenous use of these drugs may be employed. *Three of our cases, which gave us great anxiety, ceased vomiting as if by magic with the intravenous use of sodium bicarbonate alone, and the other symptoms disappeared within a very short time. Urinary findings in these cases promptly became negative.* In none of them was the blood examined.

In children, on the other hand, we feel that it may be part of wisdom to give all of them preventive treatment. That is to say, all children coming to operation should be over-fed at home for some days before coming to the hospital; they should have a full meal the night before operation and should have rich gruel with sugar early on the morning of the operation; or if the operation is not to occur till late in the morning should have breakfast. They should not be given milk on the day of operation. Broth, gruel and plenty of water are to be given, and besides these as a routine, a capsule containing five grains each of sodium bicarbonate and glucose, before operation. This may be followed after operation by further active treatment, along the same lines, if necessary, but it is believed that if this procedure were followed out before operation, postoperative treatment for acidosis in children would but rarely be necessary.

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A FEATURE OF THE ORGANIZATION MEETING OF THE MID-WESTERN ANESTHETISTS AT KANSAS CITY, OCTOBER 24-28, 1921, WILL BE A SPECIAL SESSION DEVOTED TO ANESTHESIA FOR ORAL SURGERY AND DENTISTRY. DENTISTS, ORAL SURGEONS AND SPECIALISTS INTERESTED ARE CORDIALLY INVITED TO ATTEND AND SEE HOW THE MID-WESTERN ASSOCIATION CAN LOOK AFTER THEIR SCIENTIFIC NEEDS IN ANESTHESIA. HAVE YOUR TICKET AGENT CERTIFY YOUR TRANSPORTATION SO THAT ON YOUR RETURN TRIP YOU CAN AVAIL YOURSELF OF REDUCED RATES.



# American Journal of Surgery

## QUARTERLY SUPPLEMENT of ANESTHESIA and ANALGESIA

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F. HOFFER McMECHAN, A.M., M.D., Editor  
Avon Lake, Ohio, U.S.A.

OCTOBER EDITORIALS 1921

### CURRENTS IN THE PRESENT ANESTHETIC SITUATION.

One of the most commendable actions, recently taken to make anesthesia safer for the public, is the passing of a law, by the present session of the California State Legislature, making "Anesthesiology 32 hours" a minimum requirement in the medical curriculum and for certification to practice. This law has been signed by the Governor and is now in effect.

One of its first results was the following: An interne in a San Francisco hospital refused to take instruction in anesthesia from a nurse. She was expelled for insubordination, and appealed to the County Medical Society, which sustained her position. She was reinstated and the nurse was dropped as an instructress in anesthesia.

In the present session of the Colorado Legislature a new Medical Practice Act was killed in Committee because it was against public welfare. Some surgeons and nurses were prepared to try and amend this new legislation so as to enable nurses to give anesthetics.

In Ohio, after the bill repealing nursing anesthesia had passed by an overwhelming vote in the Senate, and had been endorsed by the House of Delegates of the Ohio State Medical Association by a vote of 63 to 10, it was held up in the House until the closing hours of the session. At this time efforts were

made to amend it to death, but these were defeated. The floor leader then retired it in favor of tax legislation and just before final adjournment put it to a vote, when not enough legislators were present to pass it. In consequence the bill died with the passing of the session.

The Ohio State Medical Association, however, through its President and Council has settled on a definite policy on anesthesia, which is printed in this issue of the Supplement for the benefit of all concerned. Apparently all opposition within the Ohio State Medical Association against repealing nursing anesthesia is centered in Cleveland. Further developments will be watched with interest.

During the final Executive Session of the American Association of Anesthetists at the Boston meeting, the following resolutions was adopted:

BE IT RESOLVED, That in the future no member of the American Association of Anesthetists shall instruct any undergraduate nurse or orderly in the art of anesthesia, with the intention of granting them a certificate or diploma qualifying them as competent anesthetists

BE IT FURTHER RESOLVED, That nothing in this resolution shall effect the instruction of medical students in regular medical schools or teaching hospitals or the routine teaching of nursing.

During the meeting of the Ontario Medical Association at Niagara Falls, Canada, the draft of a new Medical Practice Act for submission to the Provincial Legislature, was accepted and endorsed. This act makes anesthesia an inviolable part of the practice of medicine.

Both at the joint meeting of the Canadian, Interstate and New York Anesthetists and the American Anesthetists it was unanimously voted to organize a National Legislative Committee to represent the interests of the Associated Anesthetists wherever and whenever required. Members of all the Associations of Anesthetists are requested to send their money order or check for \$10 as a contribution to the fund supporting the activities of this Legislative Committee.

F. H. McMechan, M.D., *Secretary-Treasurer*,  
Legislative Committee, Associated Anesthetists,  
Lake Shore Road, Avon Lake, Ohio.

### GRANT HOSPITAL, COLUMBUS, PASSES NEW RULES FOR ANESTHETIC SERVICE.

On account of several recent anesthetic fatalities, the Surgical Staff, of Grant Hospital, Columbus, Ohio, at a recent meeting passed the following rules regarding anesthetic service:

(1) The only anesthetic agent permitted at Grant Hospital for the routine production of anesthesia shall be ether,  
(Continued on Page 126)



MY CONCEPTION OF THE OHIO STATE MEDICAL ASSOCIATION'S POLICY ON  
ANESTHESIA\*

BY WELLS TEACHNOR, M.D., PRESIDENT.

*(From the Journal, O. S. M. A., August, 1921.)*

In adopting a firm and definite policy in opposition to the nurse anesthetist and repudiating the survey of the special committee, the State Association through its House of Delegates, has made clear in almost unanimous terms to the officers of the Association the course they must pursue on this subject.

The constitution provides in Section 3, Chapter VII, that "The Council shall be the executive body of the House of Delegates between sessions and shall act in its stead and with the same powers conferred on the House of Delegates by the constitution." But it does not confer on this body the authority or power to abrogate any action previously taken by the House of Delegates.

Immediately after the annual meeting the officers communicated to the members of the legislature the action of the House of Delegates in supporting Senate Bill 184 then pending, and in all other proper ways made a conscientious attempt to repeal the existing law empowering the nurse to administer anesthetics, but were met with the rush of the closing hours of the legislative session by unsurmountable opposition.

It certainly is to the interest of the public that professional ideals be maintained and that progress in medical science be encouraged rather than to extend its practice to agencies of uncertain and limited qualifications.

The action of the House of Delegates should not be construed as an attempt to belittle the intellectual powers of women or to place limitations on her attainments, nor to deprive the nurse of offices of trust and confidence, but a law legalizing the administration of anesthetics by nurses with the limited requirements of the course prescribed for them is not in harmony with the educational ideals of our profession. It is inconsistent that physicians should be made to compete with a six weeks' course as laid down for the nurse in anesthesia.

To place one with such qualifications in absolute charge of such an important surgical adjunct is too serious a proposition to merit the professional support. It is true that they will pass a sort of preliminary examination showing their ability for such work, but still they possess only partial knowledge. The extension of this privilege to the nurse is not in harmony with, and certainly invalidates one of the principal objects of our profession—"the prevention and cure of disease and prolonging and adding comfort to life."

Indeed the nurses of Ohio reasonably should be expected to oppose the present law and join with the medical profession in insisting on its repeal. By far the greater majority of nurses realize the importance of the work in their proper field and resent any effort to

exploit them outside their regular and qualified functions.

It is foolish to say that sufficient medical anesthetists cannot be secured and that the employment of nurses must be resorted to; for a proper encouragement to the specialty of anesthesia and an adequate remuneration for such service will readily solve any apparent dearth of medical anesthetists.

We should develop and encourage a constructive plan which would be an incentive for our members and which would increase professional interest in the subject of anesthesia rather than lessen the morale of the profession by extending a certain practice to outside agencies which belong as much to the doctor as appendectomy and Cesarean section. I am now convinced that the existing law means increasing inferior service to the public and a gradual retrogression of the practice of medicine.

With the matter definitely settled as a policy of the Ohio State Medical Association, the controversy insofar as the Council is concerned, has ended, and it now devolves upon Council and the officers of the State Association to lay plans for the final consummation of this trust.

It should be borne in mind that the committee to be appointed, on authorization by Council pursuant to the request of the Ohio Public Health Association, will not be authorized to alter the policy now so clearly established; but to present such policy to the other interested groups for their information and guidance on a public health question.

Any new information secured and the result of conferences may properly be submitted to the House of Delegates for its disposition at the next annual meeting. But at least until that time which will mark the expiration of my term as president of the Association, I pledge strict adherence to the mandate of the profession as set forth in the formal action of the House of Delegates at the last annual meeting in May.

Pursuant to the action of Council in authorizing the appointment of a committee to represent the position of the Ohio State Medical Association on this and other general health subjects, as requested by the Ohio Public Health Association, it is my intention to select members who represent the best thought of the profession and whose sincere and earnest efforts will be in line with the Association's policy.

Without consulting these men as to their personal ideas, but knowing from their past interest in and conscientious efforts toward the highest professional ideals, that they will constitute a representative committee, I appoint the following members: Drs. C. W. Waggoner, Toledo, Chairman; W. D. Porter, Cincinnati; D. C. Houser, Urbana; J. A. McCollam, Uhrichsville; W. A. Gallo-way, Xenia.

\*The foregoing statement as a formal communication was submitted at the meeting of the Council of the State Association in Columbus on July 10, and was adopted and ordered published by the Council.



(Continued from page 124)

given by what is known as the *open-drop* method, except that in mouth operations, or when from the position of the patient the *open-drop* method is not feasible, ether vapor may be used with the compressed air tank or with the motor pump.

(2) Chlorid of ethyl may be given as a preliminary to ether, but only in small amounts, and not continued until profound anesthesia is induced. It must never be used as a general anesthetic.

(3) Chloroform and nitrous oxid-oxygen may be administered in occasional cases; but only when specifically ordered by the surgeon or obstetrician in charge.

(4) Oxygen shall not be used as a routine procedure, but only when specifically indicated, or when ordered by the surgeon.

(5) No anesthetist shall be permitted to assist in any way in the performance of an operation. His duties are purely to give the anesthetic, and watch the patient's pulse, respiration and color.

(6) No anesthetist shall leave his patient at the completion of an operation until the patient leaves the operating room in charge of the physician who is to take him to his room.

(8) The routine fee for the giving of an anesthetic shall be \$10.00. or more if approved in writing by the operating surgeon: all fees to be collected through the hospital, which shall retain \$2.00 each for supplies. There shall be no charge for charity patients, for pupil nurses, or for medical students or physicians, except with the approval of the surgeon.

(8) The anesthetists must among themselves arrange their time so that at least one of them shall be on call at any time of the day or night. If they cannot amicably arrange this among themselves, it shall be done for them by the superintendent.

## MID-WESTERN ASSOCIATION OF ANESTHETISTS: ORGANIZATION MEETING, KANSAS CITY, MO., OCTOBER 24-28, 1922.

The Mid-Western Association of Anesthetists will hold its Organization Meeting at the Hotel Muehlebach, Kansas City, Mo., October 24-28, in conjunction with the meeting of the Medical Veterans of the World War, Missouri Valley Medical Association, Medical Society of the Southwest and the National Anesthesia Research Society.

The following papers and speakers have been scheduled for the Scientific Program:

Some Effects on the Circulatory System of Anesthesia and Operation. (President's address, Mid-Western Anesthetists) R. M. Waters, M.D., Sioux City, Iowa.

Oxygen in Relation to Anesthesia and Acidosis. Orval J. Cunningham, M.D., Kansas City, Mo.

Factors Influencing General Anesthesia. R. Stuart Adams, M.D., San Antonio, Texas.

The Diabetic as a Surgical and Anesthetic Risk. D. M. Berkman, M.D., Rochester, Minn.

The Signs and Symptoms of Third Stage Ether Anesthesia for Teaching Purposes. J. G. Poe, M.D., Dallas, Texas.

The Breath Holding Test as a Safety-First Factor in Anesthesia. W. I. Jones, D.D.S., Columbus, Ohio

The Psychology of Anesthesia. Winnie M. Sanger, M.D., Oklahoma City, Okla.

Nitrous Oxid-Oxygen Pressure Anesthesia in Relation to Empyema and Chest Surgery. (President's Address, National Anesthesia Research Society), E. I. McKesson, M.D., Toledo, Ohio.

The Present Status of Nitrous Oxid-Oxygen Anesthesia. Morris H. Clark, M.D., Kansas City, Mo.

Nitrous Oxid-Oxygen-Ether Anesthesia in Tonsil Operations: Its Technic, Advantages and Dangers. Fred M. F. Meixner, M.D., Peoria, Ills.

The Technic of Nitrous Oxid-Oxygen Analgesia and Anesthesia in Obstetrics from the Teaching Viewpoint. Arthur E. Guedel, M.D., Indianapolis, Ind.

Continuous Nitrous Oxid-Oxygen Analgesia with Re-breathing in Obstetrics: Technic of Administration and Summary of Results. A. E. Rives, M.D., East St. Louis, Ills.

Anesthesia for Dystocia. C. Henry Davis, M.D., Milwaukee, Wis.

Scope and Utility of Anesthetic Mixture. D. E. Hoag, M.D., Pueblo, Col.

Nitrous Oxid-Oxygen Anesthesia for Dentistry and Standardized Induction. J. A. Heidbrick, D.D.S., Minneapolis, Minn.

Prolonged Nitrous Oxid-Oxygen Anesthesia Technic of Administration and Case Report. Edgar W. Smith, D.D.S., Kansas City, Mo

The Surgical Management of Serious Focal Infections. T. A. Hardgrove, D.D.S., Fond du Lac, Wis.

Value of Nitrous Oxid-Oxygen Anesthesia in Preventing Systemic Reactions in Extracting Diseased Teeth. B. H. Harms, D.D.S., Omaha, Neb.

Anesthesia as a Phenomenon of Oxygen Want. C. W. Greene, M.D., Columbia, Mo.

Operations under Nitrous Oxid-Oxygen Anesthesia for Tonsil and Sinus Surgery in the Forward Inclined Sitting Posture. Ira O. Denman, M.D., Toledo, O.

The Special Session to be devoted to Anesthesia for Oral Surgery and Denistry will be held on Tuesday evening, at 8 o'clock in the Music Room of the Hotel Muehlebach, and dentists, oral surgeons and specialists are cordially invited to attend.

The Annual Dinner will be served in one of the Banquet Rooms of the Hotel Muehlebach, Monday evening, at 7 o'clock, and will be enlivened with music and clever after-dinner speakers.

The visiting ladies will be delightfully entertained, so let the Secretary know how many will be in your party.

The clinics of the Joint Meeting will be in charge of Drs. E. G. Mark, Paul V. Woolley, J. R. McVay, W. J. Frick, W. L. Gist, E. H. Skinner, C. C. Nesselrode and Morris H. Clark, of the Medical Veterans of the World War. They will be held at St. Joseph's Christian Church, Mercy, St. Margaret's, Kansas City General, Research, Bell Memorial, St. Luke's and St. Mary's Hospitals. If you wish to demonstrate some new method in anesthesia, inform the Secretary at once.

Membership in the Mid-Western Association of Anesthetists is open to all licensed and qualified members of the medical and dental professions, as well as to research workers holding doctorates of similar standing, who are interested in advancing the science and practice of anesthesia. Send for a membership application, fill in the details and return it with your check or money order for the annual dues (\$5), so that your Charter Membership Card may be sent you. Also send in the names and addresses of as many prospects for membership as you may know of.

The Organization Officers and Executive Committee will do everything they can to make this meeting interesting, instructive and enjoyable, and your cordial co-operation and support are solicited in launching the Mid-Western Association of Anesthetists on a successful career for the benefit of all concerned.

For further information address

MORRIS H. CLARK, M.D., Secretary-Treasurer,  
Rialto Bldg., Kansas City, Mo., or

F. H. McMECHAN, M.D., Organization Secretary,  
Lake Shore Road, Avon Lake, Ohio.

T. T. FRANKENBERG, Ex-Sec'y. N.A.R.S.,  
16 E. Broad St., Columbus, O.



## Book Reviews

**Regional Anesthesia: Victor Pauchet's Technic.**—By SHERWOOD-DUNN, M.D., Officer d' Academie; Surgeon (Colonel) Service de Sante Militaire de Paris; Physician to the Cochin Hospital. Pages 204 with 224 figures in the text. F. A. DAVIS Co., Publishers, Philadelphia, 1921.

Sherwood-Dunn is to be congratulated on his initiative in bringing the regional anesthesia work of Pauchet, Sourdat and Labouré to the attention of American surgeons and anesthetists. It is of further interest to note that Labat, a protegee of Pauchet, has recently been brought to America to demonstrate regional anesthesia at the Mayo Clinic.

The infiltration method of Reclus, has gradually given way to the more exacting refinements of nerve blocking, and this, in turn, has greatly extended the scope and utility of regional anesthesia in major surgery.

After discussing the advantages and disadvantages of regional anesthesia, Sherwood-Dunn presents in detail the armamentarium and general technic, after which the method is applied in detail for all operations of the head, neck, thorax, abdomen, genito-urinary organs, rectum and upper and lower extremities.

Of all the methods described the paravertebral and sacral are perhaps the most valuable and useful.

While the present volume is by no means exhaustive, it aims to cover a broad field in a concise and schematic manner, and in so doing it becomes a good manual for constant reference previous to operation.

The neuro-anatomy in relation to injections and obtunded areas are given in detail and illustrations during the course of operation are also included.

## Quarterly Index

**ACAPNIA THEORY NOW.** Yandell Henderson and H. W. Haggard, New Haven, Conn., and R. C. Coburn, New York City. *Journal American Medical Association*, August 6, 1921, Vol. 77, No. 6.

**ACIDOSIS AND ANESTHESIA.** E. Jeanbrau, P. Cristol and V. Bonnet. *Journal d'Urologie*, May-June, 1921, Vol. 11, Nos 5-6.

**ACIDOSIS FROM THE SURGICAL STANDPOINT.** A. Aimes. *Presse Medicale*, March 30, 1921, Vol. 29, No. 26.

**ALCOHOL ANESTHESIA, INTRAVENOUS.** K. Nakagawa, *Tohoku Journal of Experimental Medicine*, May 3, 1921, Vol. 2, No. 1.

**ALCOHOL INJECTIONS FOR TRIGEMINAL NEURALGIA OR GASTRIC GANGLION OPERATIONS.** V. Magnus. *Norsk Magazin for Laegevidenskab*, June, 1921.

**ALKALI RESERVE OF BLOOD PLASMA DURING ACUTE ANAPHYLACTIC SHOCK.** A. A. Eggstein, New York City. *Journal of Laboratory and Clinical Medicine*, July, 1921, Vol. 6, No. 10.

**ANESTHESIA IN THE TREATMENT OF BOTULISM.** Jacques Bronfenbrenner and Harry Weiss, Boston. *Journal American Medical Association*, June 18, 1921, Vol. 76, No. 25.

**ANESTHESIA, CURRENT PROGRESS IN THE SCIENCE AND PRACTICE OF.** J. T. Gwathmey, New York City. *Journal American Medical Association*, August 6, 1921, Vol. 77, No. 6.

**ANESTHESIA, DEPTH OF AND EFFECT OF WARMING AND COOLING SINO-AURICULAR NODE IN MAMMALIAN HEART.** B. H. Schlomovitz, Milwaukee. *American Journal of Physiology*, April 1, 1921, Vol. 55, No. 3.

**ANESTHESIA, DELIMITATION OF GENERAL, LOCAL AND SPINAL.** Berlin Letter. *Journal American Medical Association*, July 23, 1921.

**ANESTHESIA GENERAL, SOME MODERN METHODS OF.** M. C. Lidwill. *Medical Journal of Australia*, June 11, 1921, Vol. 1, No. 24.

**ANESTHESIA, HOW, MAY AID AND PROTECT SURGERY.** E. I. McKesson, Toledo. *Journal American Medical Association*, August 6, 1921, Vol. 77, No. 6.

**ANESTHESIA, SYNERGISTIC, FOR DENTAL SURGERY.** M. Ecker, New York City. *The Dental Summary*, August, 1921; and *Medical Record*, May 21, 1921.

**ANESTHETIC NOTES.** R. W. Hornabrook. *Medical Journal of Australia*, May 21, 1921, Vol. 1, No. 21.

**ANESTHETICS UNITS OF MEASUREMENTS.** A. H. Miller, Providence, R. I., *Journal American Medical Association*, August 6, 1921, Vol. 77, No. 6.

**ANESTHETICS, GENERAL, RELATION BETWEEN AMOUNT OF STAINABLE LIPOID MATERIAL IN RENAL EPITHELIUM AND SUSCEPTIBILITY OF KIDNEY TO TOXIC EFFECT OF.** Wm. deB. MacNider, Chapel Hill, N. C. *Journal of Pharmacology and Experimental Therapeutics*, May, 1921, Vol. 17, No. 4.

**ANESTHETICS, ACTION OF, ON THE LIVER.** Paris Letter. *Journal American Medical Association*, July 2, 1921.

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## TENDON TRANSPLANTATION IN CASES OF MUSCULOSPIRAL INJURIES NOT AMENABLE TO SUTURE.

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Amongst the most successful operations practiced during the war I would place tendon transplantation in cases of irreparable injuries to the musculospiral and posterior interosseous nerves. Indeed, we were able to state definitely that failures to obtain a perfect functional result were due to faults of technic or to defective after-care. It is because I have heard that some of my American friends have met with disappointing results, that I venture to present here a short note on the subject. It is clear that the operation of tendon transplantation should never be performed except in cases where the damage to the nerve, or muscles supplied by the nerve, is beyond repair. It is necessary to emphasize this, as during my inspections of military centers I found quite a number of cases where, not only did the transplanted muscles act, but the nerve, which was supposed to be beyond hope of regeneration, also recovered. From the point of view of function this was not very serious, but it was very humiliating to the surgeon and quite an unnecessary adventure for the patient.

In consequence, we made it a rule in those cases where we know that the nerve had been well sutured and the after-care adequate, and where no sign of regeneration had appeared, to wait for at least twelve months before considering the question of muscle transplantation. In cases where we had no knowledge of the operator, or the operation findings, an exploration was made without delay. The last somewhat drastic procedure was more than merely justified. I shall not deal with the indications for resection and suture of the musculospiral—they are fully dealt with in the report by the committee upon injuries of the nervous system in the section relating to the diagnosis and treatment of peripheral nerve injuries. Sufficient for my present purpose is a statement that in repair of the musculospiral a tendon transplantation is always to be preferred to any operation of neuroplasty or nerve transplant. In other words, unless an end-to-end

suture can be secured a tendon transplantation is indicated.

Before dealing directly with musculospiral paralysis, a word may be said in regard to tendon transplantation in general. The object of a transplantation is to improve and restore muscular balance. Unless this is accomplished the operation is a failure. A transplanted tendon should not be given an impossible task. However powerful it is in its normal site, when asked to perform its new function its action is at first very feeble. If given too much work to do it ceases to act, and rapidly wastes. It is therefore necessary to give it our intelligent sympathy in order to make its effort productive.

It is fundamental that the transplanted tendon should be kept in relaxation.

It should form a straight line from origin to insertion.

It should be neatly and securely fixed in its new insertion.

It should not be expected to act if passed through cicatricial tissue.

It should not be expected to correct deformity, or to move a stiff joint.

It should not be transplanted unless it has normal tone.

These axioms may seem to be platitudes, but their observance or disregard constitutes just the difference between success and failure.

The reasons for the failures one has encountered have usually been obvious, and had the surgeon recognized the importance of first correcting deformity, of mobilizing joints, of choosing a healthy transplant and securing for it a direct and unobstructed route and an appropriate tension—they would not have occurred.

Realization of these principles as applied to musculospiral paralysis should prevent us from operating in the presence of ankylosis of the wrist joint in palmar flexion. An effort should be made to mobilize the joint and, failing that, the ankylosed wrist of the hand should be made mobile, and if the flexors should be fixed in dorsiflexion. Similarly, the joints of the wrist are rigid and contracted, they should be stretched and their adhesions broken down. Mas-



sage, active and passive movements, and other physio-therapeutic measures should be directed to vitalizing the muscles, and when the transplantation is made the wrist should be dorsiflexed and the muscles fixed in slight tension. Under excessive tension muscle atrophies, while if the tendon is left too slack restoration of its function will be long delayed. In the beginning of the war I mentioned the muscles which in civilian days had served me best in relieving musculospiral disability, and the experiences gained during the war have all been confirmatory of the advice then given.

In injury of the musculospiral above the level of the origin of the posterior interosseous, the flexor carpi radialis should be inserted into the three extensors of the thumb and to the extensor of the index finger; the flexor carpi ulnaris into the extensors of the remaining three fingers. The pronator radii teres is to be transplanted into the extensor carpi radialis longior and brevior. In suggesting the use of the pronator radii teres, I was guided by my experiences with this transplantation in infantile hemiplegia, where it invariably added to the power of dorsiflexion without depriving the forearm of the power of pronation. As the radial extensors of the wrist are intact the pronator radii teres will, of course, not be interfered with in paralysis of the posterior interosseous alone.

Stiles has modified the original operation by utilizing the palmaris longus which he inserts into the extensor secundi internodii pollicis, and the flexor carpi radialis into the ext. primi inter. pollicis and into the long abductor. The flexor carpi ulnaris he attaches to each of the extensor tendons.

It is unnecessary to describe in detail the technic of the operations, but there are certain important points to remember. The dissection should be clean and the tendons very tenderly handled, otherwise adhesions form. When the flexors of the wrist have been brought to the dorsal aspect, the hand and fingers should be kept fully extended, the thumb both extended and abducted and retained in this position without variation until the operation is completed, and a suitable splint applied. In this way alone can the tendons be fixed at proper tension. To neglect this point is to invite failure. The hand is placed in a dorsiflexion splint, the wrist being kept almost at right angles, the metacarpo-phalangeal and the interphalangeal joints being only very slightly palmar-flexed in order to avoid subsequent stiffness. The after-treatment of the transplanted tendon requires watchful care.

A most excellently conducted operation may be easily spoiled by subsequent neglect. For at least a fortnight the hand and fingers should be retained rigidly in the position of dorsiflexion, and then the splint should be removed daily for gentle massage and electric stimulation. When the hand is removed from the splint the angle of dorsiflexion should not for one moment be altered, and directly treatment is over it should at once be replaced in the splint. The interrupted galvanic current offers the best stimulation and may be used, but it should not be strong enough to act upon the opposing muscles. The position of dorsiflexion should be maintained without interruption until the return of voluntary power. The fingers and the thumb should remain extended. When power has returned to the extent that the patient can voluntarily lift his fingers from the splint, the angle of dorsiflexion can be lessened in stages until the splint is straight. During this transition period, active movements of dorsiflexion should be practiced. If dorsiflexion can be voluntarily performed with the fingers and thumb extended, the splint may be gradually discarded. Even then, it is advisable to apply a short dorsiflexion splint at night to prevent dropping of the wrist during sleep. In Liverpool, we use the rigid splint in preference to the various types of apparatus allowing of movement of the fingers. Stiffness will not arise so long as all the fingers are kept very slightly bent. Recovery is usually complete in from eight to ten weeks.

It is well to strive for canons of perfection. In early days we were content with good dorsiflexion of the wrist and a partial extension of the fingers and thumb. Later, however, dissatisfaction was felt if the movements fell short of being complete. The more experienced among our surgeons expected the patient to be able to dorsiflex his wrist with fingers closed, and from that position extend his thumb and fingers while the wrist remained dorsiflexed. Particular care was taken to fully restore the function of the thumb.

On investigating the cause of failure I generally found it due to a faulty operative technic or faulty after-care, or often both. Careless dissection, rough handling of muscles, imperfect fixation of tendon, the arm and wrist kept in tension during operation, all serious initial errors, were rendered still more grave by the frequent removal of the splint while the arm was massaged with the wrist flexed, and then the complete removal of the splint before the transplanted muscles had strength to act.



It would indeed be a miracle if success followed such ruthless disregard of fundamental principles. If the operation is nicely performed and the surgeon is regardful of laws governing the education of muscles, success can be predicted.

I can quote in full agreement the words of Harold Stiles:

"Indeed it is safe to say that of all the operations which the war has added to the reconstructive list, none has given more gratifying results than the operation of tendon transplantation in cases of musculospiral paralysis".

### THE SURGICAL SIGNIFICANCE OF VOMITING.

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and

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We are entirely aware of the danger of undertaking to stress a single symptom, however important, in the recognition of diseased conditions, and especially one so commonly present as that of emesis. One is in great jeopardy of losing his perspective, of overlooking the setting, as it were, while endeavoring to force the situation to conform with his preconceived views. To admit this possibility at the beginning should go far towards neutralizing an error from this source.

It was a wise observation of a great man, that many of our mistakes, professional and otherwise, arise from a failure to utilize knowledge already in our possession, rather than from ignorance, which is equivalent to saying that our cerebration is not being operated at even moderate capacity most of the time. The significance of vomiting as a surgical symptom is the universal knowledge of all competent surgeons and medical men. When we fail to use it the fault is a graver one than where we can plead the limitations of ignorance.

A symptom common to such a great variety of diseases, in most of which it is of small importance, from its very familiarity is prone to dull our perception when it is a decisive factor. Experience would seem to impress the lesson that in every case where vomiting is present, in greater or less degree, the surgeon should endeavor to explain to himself in a satisfactory way the cause of the emesis, and where that cannot be done, and this symptom assumes marked characteristics, either in the matter of persistence, frequency, or peculiarity of vomited material, the situation calls loudly for investigation, and often for prompt relief. If this is done routine-

ly there are occasions in which it has life-saving possibilities.

Clinically, the etiological factors in vomiting may be divided into two great classes, viz., those in which the cause is limited to the stomach itself, and those associated with diseased conditions more or less remote from the stomach. The first class is not numerous, being limited to peptic ulcer, cancer, and the various causes connected with gastric irritation from food, poisons, and so forth.

The second classification contains a much larger and more complicated list. The stomach is prone to act as the signal station for a wide variety of pathologic and reflex disturbances, from pregnancy to cerebral hemorrhage, and including the neuroses. To ascribe the symptom of vomiting to its proper cause, and to invest it with a correct degree of importance, in a given case, may be a matter of some difficulty.

Since we are here considering the subject in its surgical aspects, time will not be consumed in even a superficial review of the many non-surgical causes of vomiting, except insofar as is necessary for purposes of differentiation. Viewed in this way it may be readily shown that practically all the conditions where vomiting is a matter of prime surgical importance have to do with morbid changes in the abdominal viscera. To arrive at a concrete estimate, therefore, it is often only necessary to prove to one's satisfaction that this symptom is not the result of cerebral disease, uremia, or sundry acute general diseases.

This not infrequently greatly simplifies the diagnostic significance of the vomiting, but there is left a residue of instances, in which the question cannot be disposed of so easily, as may be shown in a brief report of the histories of a few cases which seem to illustrate the difficulties, as well as the importance of recognizing the true value of this symptom.

Vomiting in appendicitis very seldom precedes the pain, but usually comes on an hour or so later, and as a symptom, it is not violent or persistent in the adult. If in an adult there is persistent and violent vomiting, or vomiting often repeated, it should be the occasion for a more thoughtful and painstaking consideration of the case. Ascertain first whether the patient has had morphia, for some people are very susceptible to this drug, and in them it may cause a considerable degree of nausea and vomiting. So if your patient, in whom you have suspected appendiceal inflammation, manifests vomiting as a persistent and striking symptom, rule out morphia. If then the cause of the vomiting is not



morphia, and you are certain that the patient has appendicitis, and the vomiting still is frequent, recurrent or persistent, it is a sign of very serious import for there is some complication present, either perforation of the appendix with peritonitis, or intestinal obstruction, or, on the other hand, your patient may not have appendicitis. As J. C. DaCosta has said, either there is more than an inflammation of the appendix, or the patient has not appendicitis. The one exception to this rule is acute appendicitis in young children, in whom the vomiting may be of a very exaggerated nature, and very persistent. We believe that the exceptions to this rule in the adult are nearly all cases of mistaken diagnoses. The history and record of a case recently seen will illustrate this:

This was a man of 33 years, who was apparently suffering from general peritonitis. He was lying in bed with his knees drawn up, and moaning with pain in the abdomen. The pulse was 120, the temperature 102°, the respirations were thoracic, the abdomen being fixed in rigidity. The history was as follows: In June, 1920, he was operated upon for appendicitis by a surgeon in another city.

It was further stated that he first began to suffer with cramps in the abdomen three years before, but they were mild then and did not cause much alarm. For the preceding eight months the symptoms had been worse, and it was for the relief of these that he came to the above operation. These were attacks of colic, which doubled him up, with the pain felt near the center of the abdomen. With the colic there was always associated vomiting, not once or a few times, but of a violent nature and many times. First there was vomited the food eaten, then a green bile-like watery material. These attacks came on irregularly, night or day, and often with great suddenness—sometimes he would be plowing in the field when an attack developed. Morphine was the only thing that ever gave him any relief. The attacks came sometimes as often as once or twice a week; and then again he might go a month or two without any at all. Each attack would last two or three hours, sometimes a whole day. The bowels had for a long time been very constipated; he never had any diarrhea or melena.

It was for these symptoms that the appendix was removed, and it is significant to note that only three or four days after the operation, he had one of the usual attacks, and has been having them at intervals ever since. There was nothing else in the history of value, and to abbreviate, the findings at the second operation, and later made complete at autopsy, were: widespread and generalized peritonitis, adeno-carcinoma of the ileum, 18 inches from the ileo-cecal valve, occluding very largely the lumen of the intestine, with metastasis in the mesentery, and finally perforation of the ileum as result of ulceration in the base of the tumor.

That this case was a mistake in diagnosis is obvious, but perhaps not dissimilar to ones that we all have made, and it is stated in so much detail only to illustrate our belief in the value of weighing and balancing the symptoms of disease carefully before reaching any conclusion as to their nature, and to lay emphasis here on the significance of vomiting. Had the violence of the vomiting arrested the surgeon's attention and suspicion, perhaps the error would have been avoided.

For the past five months we have followed our cases of appendicitis closely with respect to the symptom of vomiting. The occurrence of any vomiting at all was noted, its frequency, how soon after the pain, and whether or not after the taking of food, drugs, or cathartics. In fifty cases operated upon during this time, there was only one in whom the vomiting occurred over four times during the attack, and that one had a widespread, generalized peritonitis from a perforated appendix, and later died. Vomiting in appendicitis, then, when it assumes such prominence as to equal or overshadow the symptom of pain, should be a warning to the surgeon, calling him to pause and consider well his diagnosis. Commonly it is a symptom of so little significance in appendicitis, that unless the patient is specifically asked, he will probably not mention it, for it is usually the pain that occupies the first place in his mind.

While most of what has been said is in regard to acute appendicitis, the same rule holds true for chronic appendicitis, so-called. True chronic appendicitis is possibly best called recurrent appendicitis, since it is one or more recurring acute attacks with more or less pain in the right iliac region between the acute attacks. Of the other type of chronic appendicitis without history of any acute attack but with a miscellaneous group of reflex symptoms referred to the stomach and intestine, the same can still be said of the symptom of vomiting. It is here also an item of great insignificance. Gaither, in a recent review of the cases of chronic appendicitis observed in the gastro-intestinal clinic of the Johns Hopkins Hospital, makes this statement: "Our experience has been that these patients seldom vomit unless there is marked reflex hypersecretion, the latter being often accompanied by pylorospasm."

In cholelithiasis there is profound nausea, and usually vomiting, but in the ordinary hepatic colic, the intensity of the pain practically always overshadows the nausea and vomiting. In some cases, however, the vomiting may be violent in type. Yet



it is not often that the vomiting causes the suffering, but rather the agony of the pain. The vomiting in gall-stone colic is more common and a more noteworthy symptom than in appendicitis, but not as persistent as in obstruction of the intestine. Examination of a series of gall-stone histories will show that a large number will not vomit at all, others will vomit only 1 to 4 times, a smaller number will force themselves to vomit for relief, and in a still smaller number will the vomiting be frequent and persistent. In this disease, then, vomiting is rather irregular, rarely alarming, and nearly always less striking than the pain which is so characteristic often as to make the diagnosis relatively easy.

In gastric and duodenal ulcer vomiting occurs usually as a late symptom, when the ulcer has healed and stenosis of the stomach outlet is produced. The vomiting then is that of an incomplete obstruction of the stomach, never acute or alarming, but rather regular and persistent, once or twice each day, often at the same hour, the vomitus being large in amount and consisting of the food eaten from twelve to twenty-four hours previously. Here the vomiting is so significant that it alone makes the diagnosis self-evident, and is thus a symptom of great weight. In active, unhealed and uncomplicated ulcers of the stomach and duodenum vomiting is not conspicuous in the symptom group. In these cases it is the occurrence of pain of extraordinary regularity and constant character that lends such weight to the diagnosis. This fact will become evident to anyone who will study the accurate histories of a number of cases of unhealed ulcers operated upon.

To quote from Sir Berkeley Moynihan: "In all forms of ulceration of the stomach and duodenum vomiting is an inconspicuous feature, unless obstruction has developed as the result of the cicatrization of the ulcer. It is no uncommon experience to hear a patient say 'I never vomit,' and for an operation to disclose an extensive ulcer." "When in the record of any patient suffering from 'dyspepsia' there is a story of frequent vomiting, of inability of the stomach to tolerate the presence of any foods, of even fluid nourishment sparsely taken being at once rejected, the thought that gastric ulcer is the cause should be driven from one's mind." Nothing could be more convincing, coming as it does from probably the greatest authority on ulcer of the stomach and duodenum.

In carcinoma of the stomach, the vomiting is usually also that of pyloric obstruction. The stomach is dilated, the capacity greatly increased, and when

vomiting occurs there is an enormous quantity of material ejected, and the vomitus shows foods eaten days before. When the stomach is emptied there is a sense of relief, and vomiting does not occur again until the stomach has filled up with the foods unable to get through the pylorus. The only question in these cases is whether the obstruction is benign, as a result of a healed ulcer, or malignant, the result of a new growth.

Hematemesis, we shall mention only in passing. It may be due to one of several conditions and usually calls for a very careful differential diagnosis. The commonest cause is ulcer of the stomach and duodenum, also it occurs in malignant disease of the stomach, in cirrhosis of the liver, splenic anemia, cholecystitis, and appendicitis.

In intestinal obstruction, vomiting is always the most conspicuous, and the most constant symptom, and in any condition where there is persistent and long-continued vomiting, intestinal obstruction must be carefully considered. There may be a great deal of variation in the type of the vomiting, depending on the location of the obstruction in the intestinal tract, but always this is the leading symptom.

One of us recalls very vividly to mind the case of a young woman seen in consultation on the fourth day of an acute attack. The chief symptoms were fever, swelling in the inguinal region resembling inguinal adenitis, the mass being red, inflamed and fluctuating, and last, but not least, inability to retain anything on the stomach. Now as it happened, the vomiting was the symptom that imperatively demanded an explanation, for, when first seen, the mass in the groin could not certainly be distinguished from an ordinary bubo, and the history was vague; but the persistent emesis suggested bowel obstruction and, viewed from this angle, the bubo-like swelling in the groin took on the characteristics of a strangulated femoral hernia in the stage of gangrene with accumulation of fluid in the sac. An operation revealed a small loop of necrotic intestine surrounded by fluid in the sac of a femoral hernia.

Stenosis of the intestine, whether benign or malignant, occasionally is the cause of attacks of nausea and frequent vomiting, and should always be thought of in obscure cases, especially when there is general, indefinite, abdominal pain. These symptoms are due to a temporary obstruction of the intestine at the point of stricture, and while they endure may cause an unusual degree of suffering. Finally, with the power of the increased peristalsis, the intestinal contents are forced by the obstruction and the symptoms are almost immediately relieved. If the cause of the stenosis is malignant, its degree progresses as time goes on, the attacks become more



and more frequent as the lumen of the intestine is further narrowed, until finally complete obstruction is the result.

In acute hemorrhagic pancreatitis, vomiting is a conspicuous and often a persistent symptom. To quote again from Moynihan, "vomiting is an early symptom, is frequently repeated, and may last for days or weeks if the patient survive so long. The food that has been taken is the first to be rejected, afterwards all the vomited matters are deeply stained with bile, and pure bile to all appearances may be brought up in large quantities. This has suggested in several cases high obstruction of the jejunum." In a recent case of this disease operated upon, while the vomiting was persistent, it was not so prominent as to suggest the possibility of obstruction.

In renal colic vomiting is not infrequently present, though not until very lately have we seen it dominate the scene, obscure all other symptoms, and strongly suggest intestinal obstruction.

This case was a healthy-looking boy of 16 years, whose symptoms had begun four weeks before the first admission to the hospital. The symptoms were sudden in onset, with nausea and vomiting and inability to keep anything on the stomach, and slight, vague, indefinite pain in the abdomen which he could never localize. At this time all examinations, including roentgenography of the gastro-intestinal and urinary tracts, and analysis of the urine were negative, and he was allowed to go home because it was impossible to say where the trouble was. In about two weeks he returned, having had several of the same attacks during the interval. The vomiting had been most severe and frequent, and the vomitus had consisted of a bile-like fluid. The attacks would last from two to four days, during which time the patient remained very ill. This time everything was set for a laparotomy, the opinion being that there must be a kink or band somewhere which produced a temporary obstruction. However, we were checked in this procedure by the finding of microscopic blood in the urine on two separate occasions, though all previous urinary reports had not shown either white or red cells. This very naturally threw a new light on the case, convinced as we are that red blood cells in the urine, however small their number and even in the absence of numbers of pus cells, are always significant of a lesion somewhere in the urinary tract. Consequently, a pyelographic study was made and revealed a moderate hydronephrosis on the right side, and with this aid second *x-ray* plates showed a very indistinct shadow of a stone in the distal end of the right ureter causing obstruction. It is worthy of note that only after very careful *x-raying* was this stone demonstrable. After this we allowed the patient to go home for a week-end before beginning any form of treatment. While there, he was taken with one of the usual attacks of nausea and vomiting, and two days later was brought

back to the hospital in a very bad condition. He was vomiting every little while, and immediately, everything taken by mouth. The pulse was small and soft, the tongue was dry and parched, and the patient seemed weak and toxic from the loss and lack of fluids. Even at this time, the family physician was most inclined to believe the case one of obstruction of the bowel. Solutions by rectum and intravenously were necessary to restore the patient, and then it was a very gradual process. Dilatation of the ureter and passage of the stone has so far relieved all recurrence of the symptoms. Unquestionably obstruction of the ureter and the production of a hydronephrosis was the cause of the symptoms. In spite of this, there was never any tenderness over the right kidney region, the kidney was not palpable, and there were no bladder symptoms. There was nothing to point to the urinary tract except the microscopic blood in the urine.

Vomiting may occur in almost any type of cerebral disease, most notable of which is tumor, tabes dorsalis and cerebro-spinal lues. In tumors of the brain the vomiting is said to occur without nausea, with a clean tongue, and to be projectile. Eye-ground studies, examination of the reflexes and of the spinal fluid are all of profit in reaching a diagnosis in any case of obscure attacks of violent vomiting.

There are cases of hysterical vomiting that may assume such a degree of gravity as to add to our complexities,—but there are often other nervous features that materially aid us in recognizing these cases.

In a person beyond middle age, or in a younger person who is known to have nephritis, an attack of persistent nausea and vomiting so severe as to render that person ill must surely suggest the possibility of uremia as the etiological factor. Osler says "the gastro-intestinal manifestations of uremia often set in with abruptness. Uncontrollable vomiting may come on and its cause be quite unrecognizable. The attacks may be preceded by nausea, and may be associated with diarrhea."

A man of sixty-five years was seen in consultation. This man had had an inguinal hernia for a number of years, and the day before he was seen, it had become caught and could not be reduced as formerly. After some manipulation, however, his physician succeeded. A short while after this the patient began to suffer with nausea and vomiting, and it was then a question whether or not he had intestinal obstruction, as result of a twisting of the bowel in the reduction of the hernia. Observing that the kidney output was much reduced, and that there were many casts in the urine, and examination of the blood showing a urea retention of 75, in connection with other features of the case, led us to the conclusion that this was a case of uremia. Conse-



quently he was treated medically, got over the attack and left the hospital. The blood pressure, contents of the urine, condition of the entire cardiovascular system, and the retention of urea and nitrogen bodies in the blood above the normal limit, all are of value in the consideration of the significance of nausea and vomiting in an elderly person.

In conclusion, vomiting is a symptom of a great variety of surgical diseases and as such it is worthy always of a careful explanation, a detailed weighing and balancing with the other symptoms of the case, and after this there can be no doubt that it will aid us very distinctly in arriving at an accurate diagnosis.

### TRAUMATIC RUPTURE OF THE SPLEEN. REPORT OF A CASE.\*

GUY P. GRIGSBY, M.D., F.A.C.S.,  
LOUISVILLE, KY.

Traumatic rupture of the spleen probably occurs oftener than is generally believed, and doubtless many fatalities have ensued from this cause where operations were refused. Extensive splenic damage sometimes results from slight trauma and without external evidence of internal injury, as was true in the case to be herein recorded. Unfortunately, pre-operative diagnosis of splenic rupture is fraught with difficulty, the symptoms usually being similar to those noted in other traumatic lesions of abdominal viscera. Where there is a history of trauma involving the left hypochondrium, especially with the slightest indications of internal injury, the surgeon should suspect rupture of the spleen, and I believe it is his duty to advise immediate exploration. It must be remembered, however, that the severity of early symptoms is no index to the extent of splenic damage; for obvious reasons even the signs of internal hemorrhage may be delayed for several hours. Increasing abdominal pain, tenderness over the left costo-vertebral angle without hematuria, a definite increase in the leucocyte count, an increasing area of dullness in the left flank, persistent shoulder pain without joint injury, are among the important early diagnostic points. Rarely are nausea and vomiting noted as early manifestations. In the majority of instances all indicative signs are delayed for several hours.

In the differential diagnosis the following must be considered: perforated gastric or duodenal ulcer, rupture of the kidney, hemothorax, mesenteric embolus, etc. Connor emphasizes several prominent

diagnostic signs of splenic rupture: (1) the history of left-sided trauma; (2) a definite interval between the infliction of the trauma and the patient's realization of serious injury; (3) pain in the left chest and shoulder; (4) difficulty in breathing; (5) signs of internal hemorrhage, i. e., cold white skin, soft, rapid pulse, subnormal temperature during the first six hours; (6) abdominal rigidity; (7) an increasing area of dullness in the left upper quadrant and flank.

Surgical experience and observation have taught us that the prognosis in traumatic rupture of either hollow or solid abdominal viscera depends almost entirely upon the time that elapses between infliction of the injury and the operation. Medical treatment in such instances merely represents a delusion and a snare excepting insofar as it relates to sustaining and improving the vital resistance of the individual.

H. K., a male, aged 36, wood carver, was admitted to the Jewish Hospital (Louisville, Ky.), May 2, 1920, fourteen hours after having been kicked in the abdomen by a horse. He received two blows, one on the upper portion of the abdomen, the other involving the left lower quadrant. While there was some abdominal pain shortly after the injury, the man did not realize that he was seriously hurt until several hours later. The accident occurred at eleven o'clock in the morning, and at five in the afternoon pain became so intense that he called the family physician. In the meantime the patient had two alvine evacuations and thought he passed considerable blood or blood-tinged fluid each time. The physician immediately recognized that the patient was in a desperate condition and hurried him to the hospital, where I saw him shortly thereafter. I found him sitting up in bed and it was apparent that he was in great distress and deep shock.

Examination: Pulse 112, temperature 96.4° F. The abdomen gave no evidence of external injury, but seemed to be distended with fluid. Pain could be elicited only over the left iliac region. Any attempt to induce the patient to assume the recumbent posture met with frantic resistance, as he said it caused intense pain in both shoulders, particularly in the right. Rectal examination disclosed no free blood.

In view of the history, the eliciting of pain in the left iliac region, and the fact that the patient had passed blood by the rectum, we suspected injury of the descending colon; at any rate, there was no question that immediate celiotomy was indicated, and he was taken to the operating room without further delay. It was necessary to administer the anesthetic with the man in a sitting position on the operating table, as he could not be induced to recline on account of the increased pain.

A median incision was made below the umbilicus. Immediately upon opening the peritoneum there es-

\*Some of the details of this case were reported and the patient exhibited at a meeting of the Jefferson County, Ky., Medical Society in March, 1921, and will eventually appear in the transactions of that organization.



caped half a gallon of fluid blood; but as there was neither evidence of feces nor odor we concluded there was no intestinal injury. During the space of a few seconds the hemorrhage was so terrific and persistent that I realized it must originate in either the liver or the spleen, and the incision was immediately extended to the ensiform cartilage. The patient was completely and quickly eviscerated which enabled us to determine the source of the hemorrhage.

The lower end of the spleen seemed to have been entirely "blown out" and a terrific hemorrhage was occurring therefrom. The patient's condition at this juncture was most grave and we thought he would die on the table. Fortunately, I was able with my left hand to grasp the pedicle of the spleen and by firm pressure control the hemorrhage. Further investigation showed that the spleen had been split into three portions, the ruptures extending into the pedicle. The organ was three or four times its normal size and rather densely adherent to the parietal peritoneum from which considerable effort was required to free it. The spleen was then delivered through the incision, the pedicle clamped with forceps, and the organ removed. The pedicle was ligated with chromicized catgut, and after being certain that all hemorrhage had been controlled, was allowed to recede into the abdominal cavity. The viscera were then replaced and the wound hastily closed without drainage.

The patient's condition at the close of the operation was exceedingly critical. He was given a saline transfusion, which to some degree restored the pulse. The following morning a suitable donor was found and transfusion of 600 cc. of unmodified blood was made. Unquestionably this turned the tide in our favor, as there was marked improvement in his condition following the transfusion. Convalescence was uneventful, except for a small stitch abscess. The patient was dismissed from the hospital in good condition on the twentieth day after operation. Three blood examinations were made while he was in the hospital and practically normal findings reported.

I did not see the patient after he left the hospital until March 21, 1921. He then said he had enjoyed perfect health since the operation, that he had been working regularly, and had gained twelve pounds in weight. Except for an occasional pain in the shoulder he has had no discomfort. His appearance indicated that he had an abundance of blood.

An interesting point in this case, which has been noted by other observers, is that while splenic injury may be serious, rarely are grave symptoms noted at first. The symptoms appear gradually and, within a few hours after injury, become pronounced, just as happened in this instance. Persistent shoulder pain is not always a prominent manifestation of splenic injury, but was present in this case and has been mentioned by other surgeons.

It is said (Miller) that as early as 1500 spleens

were removed from animals without detriment to their general health; that Aristotle (according to Krumbhaar) suspected the spleen was not essential to human life. In 1549 Zaccarelli extirpated the spleen from an individual with satisfactory outcome. The earliest splenectomy in this country is said to have been performed by Browne, in 1814, the patient remaining in good health after the operation. In 1866, Quittenlaum, Spence, and Wells removed spleens not only in cases of injury, but also from individuals suffering with constitutional disturbances and splenomegaly. "The revolutionary period of splenic surgery, however, must be considered from 1894, when Banti described the disease which bears his name." (Miller).

So far as can be ascertained by search of available literature there have been recorded about 300 cases of traumatic rupture of the spleen which were treated surgically. In 1909 Brogsitter, as quoted by Willis, reviewed the literature of traumatic rupture of the spleen, and collected 203 cases treated by surgical means. This number may be divided into two series, the first including the cases summarized by Berger, in 1907, comprising a total of 168, and the second including the cases reviewed by Brogsitter, a total of 35. In the first series splenectomy was performed in 135 instances, with a mortality of 38.7%. Barnes, in 1914, reviewed the literature since Brogsitter's paper and found record of 30 cases of rupture of the normal spleen occurring between 1909 and 1914, his own case making a total of 31. Since Barnes' contribution, says Willis, there have occurred or were omitted from his summary 53 cases, to which the author (Willis) adds 4, thus making the total 57. Splenectomy was performed on 55 patients with a mortality of 28.88%.

A review by Henderson of operations at the Boston City Hospital since 1914 shows 10 cases of ruptured spleen, 8 of which were traumatic and 2 spontaneous (typhoid fever). Of these ten patients 4 survived the operation of splenectomy. Only once was the diagnosis of ruptured spleen made before operation, and that was in one of the typhoid cases. With the exception of one, the pulse on admission ranged from 120 to 160, and in all (exclusive of the typhoid cases) the temperatures were subnormal. Only one of the patients who recovered was transfused with whole blood; the other three had intravenous infusions of saline solution. Seven of the ten showed no external injury suggesting splenic trauma; two of the remaining three had fracture of ribs over the spleen; the other had only lower chest



tenderness. The author emphasizes the fact that immediate operation is essential.

Willis' 4 patients were males and each had received a blow over the splenic region. There was no external evidence of internal injury. Secondary anemia, leucocytosis, rigidity and tenderness were noted. All four patients were subjected to splenectomy. Three had agonizing pain in the left shoulder which was relieved by the operation. In two, marked leucocytosis persisted several weeks after splenectomy. Three of the patients recovered. The other, who died eight days after operation, showed a continuous reduction in hemoglobin and number of leucocytes. In two cases direct transfusion seemed beneficial.

Lefevre's patient had sharp pain in the left thoracic region shortly after a fall and was assisted to the hospital. Examination showed pulse only slightly weakened, abdomen relaxed except beneath left costal border where there was some resistance. Pain continued, became progressively more intense, and later abdominal rigidity was noted. Diagnosis: intraperitoneal hemorrhage, probably due to rupture of spleen. At operation the abdominal cavity was found filled with blood. The spleen was easily exposed and found separated into two parts by rupture perpendicular to its major axis. The pedicle was ligated and the organ removed. The post-operative course was uneventful. The author believes rupture occurred in two stages, i. e., there was first a parenchymal rupture with intrasplenic hemorrhage and formation of a subcapsular hematoma, then upon exertion capsular rupture and peritoneal inundation.

Connor reports 3 cases of splenic trauma. One patient died before an operation could be performed, but the other two recovered following splenectomy. No further details in the abstract from which these data were obtained.

#### CONCLUSIONS.

(1) The spleen is the most mysterious of all the ductless glands; its function and consequent value to the human organism have not been definitely established.

(2) Traumatic rupture of the spleen occurs with greater frequency than generally supposed; many fatalities in unoperated cases are doubtless correctly attributable thereto.

(3) The causative trauma may have been so slight as to produce no external evidence suggesting internal injury; yet the spleen may have been extensively damaged.

(4) The primary symptoms of splenic rupture may not be indicative of serious internal damage; the signs are usually delayed for several hours and then they progressively increase in severity.

(5) The pre-operative diagnosis of traumatic rupture of the spleen cannot always be perfected; but following the infliction of trauma in this region the surgeon should consider the possibility of splenic damage especially where there is delay in development of symptoms.

(6) The treatment of ruptured spleen is distinctly and essentially surgical; medical management represents a delusion except insofar as it relates to the maintenance of physical resistance.

(7) To an experienced surgeon the technic of splenectomy is not so difficult as was formerly taught; the operation should be undertaken without hesitation when demanded by the conditions present; and the same rule holds true as applicable to traumatic lesions of other abdominal viscera, i. e., "the earlier surgery is applied the greater the chance of a favorable outcome."

(8) The prognosis in ruptured spleen depends almost entirely upon the time intervening between infliction of the trauma and the institution of surgical treatment; fatality usually follows late operation after vital resistance has been greatly reduced by continued hemorrhage.

(9) Finally, the only hope of reducing the prevailing high mortality from splenectomy for traumatic rupture lies in earlier surgical treatment; there seems no legitimate reason why the immediate mortality from splenectomy should be greater than that following operations upon other abdominal viscera; the remote mortality cannot be even approximately estimated upon present knowledge.

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#### ANNOUNCEMENT: PROCTOLOGY ISSUE.

The next number of the JOURNAL will be a special issue devoted to proctology. It will contain the papers read at the 22nd annual meeting of the American Proctologic Society in Boston, June 3-6, 1921.



## RESULTS FOLLOWING 245 THYROIDECTOMIES.

JOSEPH L. DECOURCY, M.D.  
CINCINNATI, O.

The following discussion and conclusions are based upon 245 thyroidectomies out of 542 goiter cases examined at our clinic from March 1, 1916, to March 1, 1921. Of the 245 cases operated upon, 216 had been treated before operation. Eighty-four had received five or more exposures to the *x*-ray; 16 had received injections directly into the gland, while the remaining 116 had received medical treatment internally, a large number also using local applications of iodine preparations on the goiter itself. Of the series, 38 were given *x*-ray exposures under our own supervision. Most of these cases were of the exophthalmic type with little or no enlargement of the thyroid gland itself. In nearly all of these cases the pulse became slower after



Fig. 1. Wheal injection of 1-10% cocaine solution.

3 to 5 exposures, but invariably returned to its abnormal beat within six months following, with the general symptoms more marked than before. Of the cases that did not go to operation, 103 were of adolescent goiter; of these 25 were given thyroid extract only, 25 were given a combination of extract thyroid gr.  $\frac{1}{2}$ , extract hypophysis gr.  $\frac{1}{2}$ , and corpus luteum gr. 2, while 53 were given the above combination with occasional courses of syrup of hydriodic acid or sodium iodid. Eighteen of the cases receiving thyroid extract only have now been under observation for four years or over; 16 may be considered cured while two have grown progressively worse and nodular, giving evidence of adenomatous changes. In no case of the adolescent type, however, was the reduction in the size of the enlargement striking; those that gradually went on to normal reduction seemed to do so in spite of treatment, while those that continued to

grow large also did so in spite of treatment. The colloid type of goiter was readily reduced in size with the above combination but in most instances the reduction was only temporary. Hypertrophies occurring following bilateral thyroidectomies, however, were permanently reduced with thyroid extract.

Of the 245 cases that went to operation 80 were



Fig. 2. Skin incision, usually made over the most prominent portion of the goiter.

of the exophthalmic type, 72 of which were ligated before thyroidectomy; 136 were adenomatous, while 28 were colloid, cystic or fibrous hypertrophies. Only one case showed evidence of carcinoma when studied microscopically. Of the 245 thyroidectomies there were two deaths following bilat-

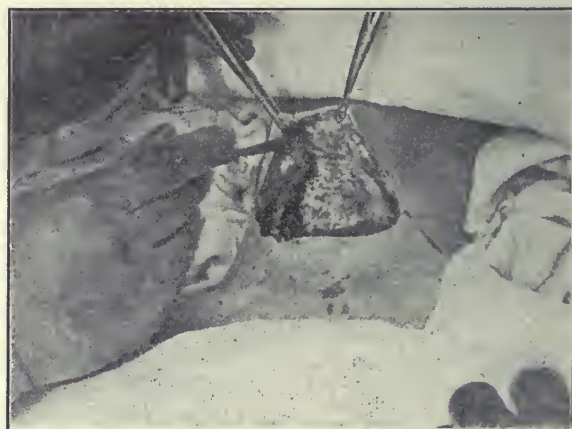


Fig. 3. Retraction of flaps.

eral lobectomy, one death following unilateral lobectomy, and one death following simple single ligation. No cases of this series were refused operation because of advancement. Of the 165 cases that were not considered of the exophthalmic type there were no deaths and all cases were discharged as cured within four months following operation. The most gratifying cases were the return to normal of



the extreme toxic adenomata following bilateral resection. Of the 80 exophthalmic cases there was a gradual improvement immediately following operation. A post-operative regime of treatment, especially excluding work or worry that was inductive to fatigue, was insisted upon, and although the period following a number of these operations is short, yet many are now in their fifth year and from the return of our follow-up circulars, a copy of which is

beyond her normal "zone" of endurance, whether this stress be mental or physical. For instance, we see goiter commonly in the lower class of farmers, women who have raised large families on meager incomes, teachers and students, especially teachers who are Sisters of the various religious orders, who together with their work have little or no recreation. Frequently we see nurses in training suddenly develop exophthalmic goiter.



Fig. 4. Midline incision extending through the surgical capsule of the gland.

presented, we have estimated an improvement consistent with a normal endurance in 90% of cases. In our department of internal medicine 32 cases of exophthalmic goiter treated over a period of four years show only 20% of similar cures.

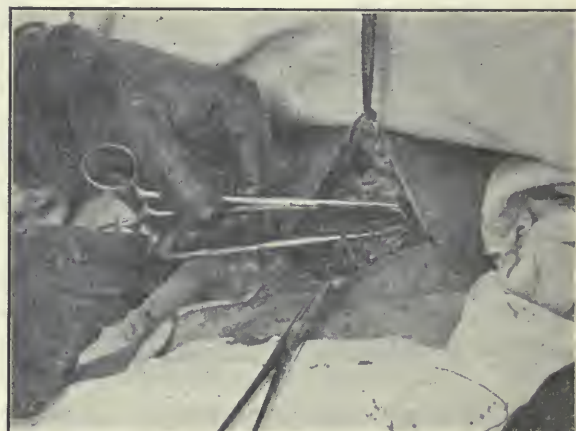


Fig. 6. Clamps applied to muscles and capsule, and division between.

The preponderance of goiter in women can be accounted for by a lower point of normal endurance than that found in men. It is a well known fact also that many men developed goiters when suddenly thrown under the stress of army life.

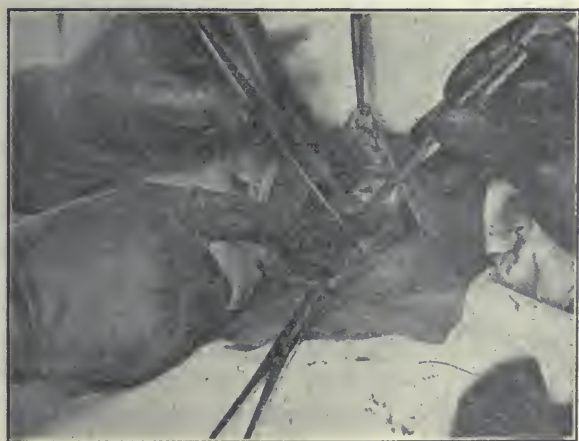


Fig. 5. Freeing the gland from overlying structures.

The etiology of goiter is in the foreground of surgical discussion at present and very valuable work is being brought forth. In taking the histories and examining a large number of goiter patients it has been impressed upon me that "fatigue" plays an indisputable rôle in the causation of goiter. In almost every instance the patient with a goiter has undergone a stress in life which has carried her

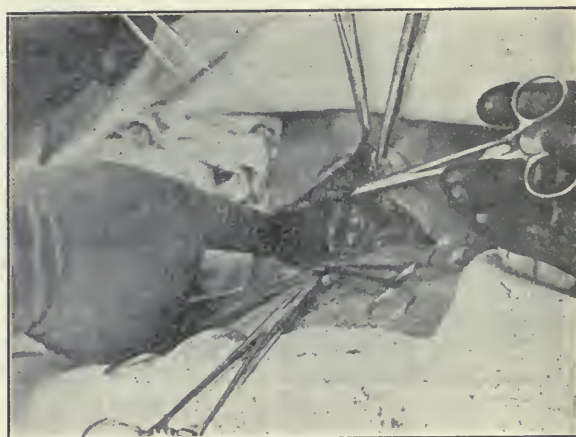


Fig. 7. Finger elevation of the gland (exophthalmic goiter).

Just how fatigue affects the thyroid it is hard to conjecture—whether through an acidosis, or through a gradually increased call upon the thyroid secretion. I believe that a similar condition exists in the prostate gland that develops an adenoma, possibly from overuse. The most logical way of accounting for the formation of an adenoma is a com-



pensatory increase in cells in order to make up an existing deficiency.

Every person has a normal zone of endurance which is individualistic in its characteristics. This zone may be decreased or increased by various external and internal conditions: externally, by our mode of living, excesses, abuse, atmospheric conditions, hygienic conditions, mental strain, etc.;

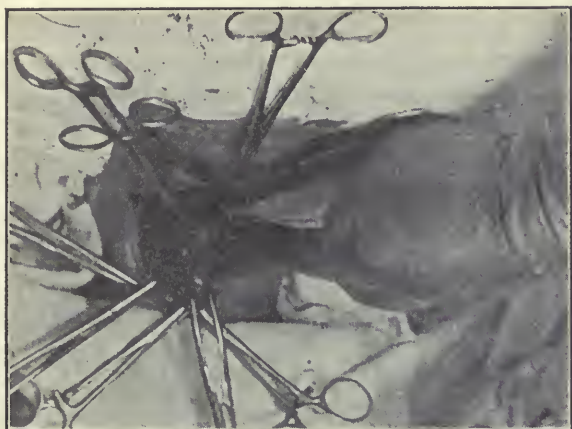


Fig. 8. Hemostat applied to inferior thyroid artery after the gland is elevated. Artery is being severed above the hemostat.

internally, by gradual toxemia from the intestinal canal, fevers, etc. The zone may be decreased or increased only by changes gradually induced, and has a limit. An example may be the athlete who

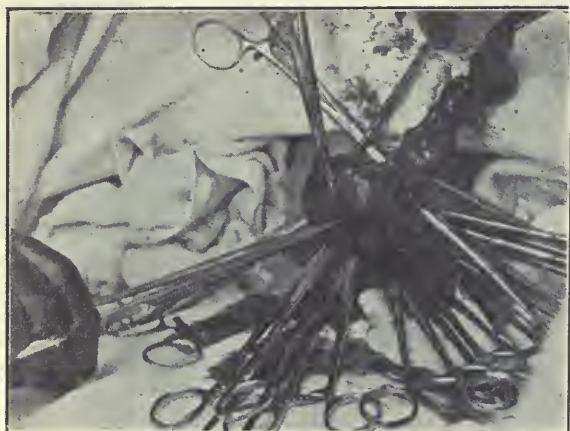


Fig. 9. Left lobe and isthmus excised. Beginning excision of right lobe.

must train slowly if his endurance is to be increased. The glands of internal secretion act normally within the "zone of endurance". Let this zone be exceeded or fall below the normal limit, however, and one of several changes must take place. If the zone has been exceeded suddenly then the glands, whichever they may be, are activated to sudden hypersecretion, and if this gland be the thyroid then hyperthyroid-

ism suddenly develops. We see this in the sudden advent of exophthalmic goiter in persons placed under an abnormal strain. I recall a case of a clerk who, desiring an outdoor position, began driving an ice-cream route wagon, which demands heavy lifting and which pays the driver by the percentage of sale in order to encourage abnormal energy. This man, after two weeks' work, suddenly developed an

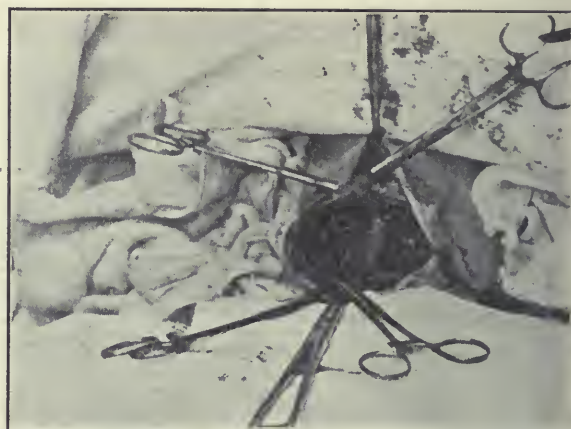


Fig. 10. Operative field following bilateral resection, showing exposure of the trachea.

exophthalmic goiter, which disappeared after his return to his former occupation. If, on the other hand, the zone has been exceeded gradually, then the changes in the gland are apt to be by a gradual



Fig. 11. Muscle clamps brought together ready for suture. increase of cellular elements and an adenoma develops. This is undoubtedly the most common tumor of the thyroid and is seen in persons whose zone of endurance has been gradually exceeded or diminished by either physical or mental fatigue, or both.

Once a pathologic condition develops in the thyroid gland there is a possibility of the tendency thereto being transferred from mother or father to daughter or son. That certain atmospheric, climatic



and material differences are more inducive to fatigue than others would possibly account for the geographic distribution of goiter. I do not know the incidence of goiter in the negro but I believe it to be comparatively small, possibly because of the indolent disposition so common among them.

The controversy over the various forms of medi-



Fig. 12. Skin clips applied. They are removed on the third day following operation.

cal and surgical treatment may be discussed as follows:

In the simple forms of goiter of the adolescent period, iodine and thyroid medication seems to be



Fig. 13. The patient as seen immediately following operation.

the logical treatment, because the iodine content of the thyroid is diminished in this type of hypertrophy and because the enlargement of the gland seems to be a reaction on the part of nature to make up the iodine deficiency that is present. In persistent goiters, however, one must be careful in the use of iodine because it will frequently induce a degenerative process and toxic symptoms may develop.

Surgical interference is unquestionably indicated when there is a tumor formation, such as adenoma,

or when degenerative changes are in progress, as evidenced by toxic symptoms. Rest with starvation, and possibly symptomatic medication, may lessen the activity of the abnormal thyroid, but I believe that the thyroid gland becomes a focus of infection, so to speak, as soon as it becomes pathological. In other words, in a patient suffering from thyrotoxicosis, the toxemia is coming from the abnormal thyroid and in exophthalmic goiter hypersecretion is also coming from the thyroid, therefore to effect a cure the thyroid activity must be lessened and the pathologic condition must be removed.

A post-operative regime, keeping the patient well within his "zone of endurance" and insisting upon a certain amount of relaxation and recreation, is requisite to successful surgical results.

#### FOLLOW-UP QUESTIONNAIRE OF THE

#### DECOURCY CLINIC

Cincinnati, O.

Dept. of Surgery—Dr. Joseph L. DeCourcy

Dear.....

We are enclosing the following list of symptoms in order to determine your condition following your operation.

An answer to the following questions at your earliest convenience will be greatly appreciated.

#### DECOURCY CLINIC.

Do you notice—

1. Nervousness? Answer .....
2. Enlargement of neck? Answer .....
3. Tremor of hand? Answer .....
4. Rapid heart beat? Answer .....
5. Weakness? Answer .....
6. Difficulty in getting to sleep? Answer .....
7. Swelling of feet? Answer .....
8. Throbbing headaches? Answer .....
9. Loss of weight? Answer .....
10. Change of voice? Answer .....
11. Prominence or tiring of eyes? Answer .....
12. Excessive sweating? Answer .....

#### PALPATION OF THE URETER

Contrary to the general method advised, which is that palpation be made for the ureter in the anterior vaginal fornix, I suggest beginning at the lateral vaginal fornix, using the left index finger for the left ureter and the right index finger for the right ureter. The normal ureter presents itself as a slender cord, with its convexity outward and forward, and with a restricted mobility, due to its anatomical relationship with the peritoneum and side of the pelvis. It is smaller than a goose quill, feeling about the size of an ordinary leather shoestring. It is best palpated by sweeping the finger above the point of its location and then slightly bending the ends of the fingers, as one might in picking the strings of a guitar, sweeping them down over the ureter, straightening the finger out and going back and bending it again before going down, always getting the feel of the ureter from above downward, and not from below upward.—A. M. JUDD in the *New York Medical Journal*.



FOCAL INFECTION, WITH ESPECIAL  
REFERENCE TO THE TONSIL.J. H. HESTER, M.D.,  
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The subject of focal infection, being almost unlimited in its scope, will necessarily cause me to confine my remarks principally to my own field of practice. The time has passed when the physician can say to his patient that he has rheumatism, neuralgia, nervousness, neurasthenia, anemia, or apply any other obsolete term to designate supposed existing disease, and escape criticism; the average patient nowadays will demand something more definite and tangible.

The two factors that have been of the greatest assistance in solution of the problem of focal infection are: First, co-operation between the general practitioner, the internist, the surgeon, the neurologist and other specialists in medicine,—and last, but by no means least, the dentist. Second, a systematic and thorough examination and complete record of the history of every patient who applies for examination and treatment. In this way it has been possible to avoid many mistakes.

The greatest handicaps that surround the general practitioner of medicine are: First, lack of time and equipment to make the necessary investigations. Second, some patients are physically and financially unable to travel to the city where thorough examinations can be made. (And just here I would like to predict that in the near future city physicians will accept these patients and give them thorough and systematic examinations, and whatever amounts they are able to pay will be prorated among those making such investigations.)

It is recognized that the sites of chronic infection about the body are many, and include the tonsils, teeth, sinuses, prostate, gall-bladder,—to name only a few of the most common. It is also a matter of general observation that many people have infection at one or more of such sites for months or years without suffering from metastatic lesions in joints, eyes, or elsewhere, so far as may be determined upon clinical investigation. They may be entirely ignorant of the presence of infection in the body.

The chief factors that determine whether infection shall remain confined to its local site, or whether it shall extend into adjacent or distant parts of the body, may be grouped under three headings: (1) the virulence of the invading organism; (2) the nature and extent of the infected tissue, and (3) the resistance of the patient.

Bacteria and other disease-producing agencies vary widely in their ability to invade and produce changes in animal tissues, and this variability of action depends upon a number of conditions, among which are: the presence or absence of available food supply, suitable oxygen tension, and the degree of protection offered the bacteria against the fluids and cells of the host.

One species of animal may be naturally resistant or immune to infection by certain organisms, whereas another species may be extremely susceptible. Different individuals of a species may differ widely in their susceptibility to a given infection, and this difference in individuals is frequently observable in man.

We commonly think of a virulent organism as one which, like the streptococcus in erysipelas or cellulitis, is able to invade the tissues rapidly with resulting edema, pain and a stormy illness. This conception, while correct so far as it goes, is incomplete and should not divert attention from infections that proceed more slowly, often unnoticed for a time, but in which the progress of invasion of the host by the bacterium is no less sure. Infection of the latter type is illustrated by some of the common forms of tuberculosis. The chronic types of metastatic disease of joints and eyes arising from infections about the tonsils and other localized areas throughout the body, in their chronicity and in the relative absence of symptoms of systemic disease, resemble the latter more than the former group, although all degrees of acuteness of both primary and secondary lesions may be found. The process of invasion consists, however, of a series of short steps rather than one continuous process.

The tonsils constitute the most vulnerable portion of the upper respiratory and digestive passages. Owing to the anatomical structure of the tonsillar crypts, microorganisms readily lodge therein where they may grow and multiply. The mucous membrane lining the crypts is frequently damaged, and opportunity is thus afforded for the penetration of bacteria into the substance of the gland and thence into other parts of the body. Infections of the tonsils are frequently produced by streptococci and other forms of cocci, by the organisms of Vincent, and by the diphtheria bacilli. The tonsils may also be the portals of entry for tuberculosis, syphilis and other diseases. Foci of infection in the tonsils may be the source of acute or chronic sepsis; and the intimate relationship between tonsillar disease on the one hand, and arthritis, endocarditis and nephritis



on the other, has been repeatedly emphasized in recent years. Removal of the tonsils from such patients may check a low grade sepsis, or it may guard the individual against future bacterial invasions from this source.

The tonsil serves as the port of entry of pathogenic organisms and has an enormous influence in spreading infection to distant organs through the chain of lymphatics with which it is intimately connected, and through the blood stream. The normal tonsil harbors disease-producing microorganisms at all times; the diseased tonsil is a greater menace, for in its crypts are conditions that invite local proliferation and consecutive constitutional infection.

Tonsils in which there are no apparent changes have been proved experimentally and clinically to hold the organisms of cerebrospinal meningitis, pneumonia, "rheumatism", endocarditis, poliomyelitis, and many other disease-producing agents.

Further, it may be contended with considerable certainty that many chronic diseases, the causes of which have not been understood in the past, are being favorably influenced by the enucleation of both large and small tonsils. Among these diseases are the various forms of so-called chronic rheumatism and rheumatoid arthritis, pyemia, sepsis, nephritis, Hodgkins' disease, and pernicious anemia.

In addition to focal infection of the tonsil and adenoids, the accessory sinuses, viz., the frontal, ethmoidal, maxillary, sphenoidal, and the mastoid, must be considered. Chronic infection of any of these sinuses may cause almost every systemic disturbance that could be produced by an infected tonsil, and frequently the diagnosis is more difficult as the infection may be accompanied by little or no pain. If, however, pain occurs, it is more severe in the morning. This refers to chronic cases, as we all know acute cases give rise to quite severe pain. I am sorry space will not permit me to say more on the sinus question, but it is a big subject of itself.

The fact has been well established that the teeth and gums are just as important as foci of infection in those beyond middle life as are the tonsils, sinuses, etc. There are many physicians today who think the profession is entirely too radical in its enthusiasm in claiming that many hitherto inexplicable conditions arise from apical disease of the teeth and disease of the peridental tissue, particularly the gums. I believe it was Rosenow who first demonstrated the importance of the streptococcus viridans in various systemic conditions. Since then the profession has been ridiculed and doubtless criticized

for its enthusiasm in removing dead teeth and treating diseased gums.

In all cases of neuritis, arthritis, and certain types of cardiac and renal disease occurring in individuals beyond the age of forty-five years, the teeth should be suspected and carefully investigated. Before the age of forty-five years, the tonsils and paranasal sinuses are the most probable sites of focal infection. If our enthusiasm along these lines has led us too far, it has been along the path of safety. We had better remove hundreds of harmless tonsils and teeth than to leave one so diseased as to be a future menace to health and life.

The following case records are submitted as typical of the various types of focal infection:

CASE I. Mr. K., aged 21, was referred to me by a local surgeon to whom he had been sent by the family physician to have his legs straightened. This young man had suffered from rheumatoid arthritis for three years, during which time he had been unable to walk. His family physician had done everything possible for him in the way of medical treatment before sending him to the surgeon. The latter recognized the nature of the affliction and asked me to see the patient. I found he had diseased tonsils and advised tonsillectomy. The operation was accordingly performed with the result that the patient was able to walk without discomfort within four weeks.

CASE II. Miss W., aged 17, was referred to me by Dr. B. for removal of her tonsils which were enlarged and infected. She gave a history of having had "rheumatism" for more than two years and also some cardiac disturbance which her physician had diagnosed as organic in type. Three months after tonsillectomy her physician reported to me that the cardiac lesion had disappeared, she had no further attacks of "rheumatism", and had remained well.

CASE III. Mr. S., aged 17, was referred to me by Dr. S. with the diagnosis of acute miliary tuberculosis, with the opinion that the tonsils should be removed. I readily agreed with him, but the patient's condition at the time was such that operation would have been extremely hazardous. I advised the family physician to institute treatment that would improve his physical status, if possible, so that tonsillectomy could be performed with a greater degree of safety. Treatment was only partially successful and when the patient returned to me his pulse was 120, respirations 26, temperature 100.4° F. I told the physician and family that I did not care to operate upon the patient unless they would assume all the responsibility in the event of death. To this they agreed and tonsillectomy was performed the following morning. The patient's condition became critical from the anesthetic and we feared he would die on the operating table. About two hours after the operation I was hurriedly recalled to the hospital on account of severe hemorrhage. The patient finally



rallied and made a satisfactory recovery. Two months later his physician telephoned that the patient had gained thirty pounds in weight and his pulse, respiration and temperature were practically normal. Such an improvement he had never seen before.

CASE IV. Mrs. A., aged 53, wife of a physician, was brought to me by a former patient upon whom I had successfully operated for what was presumed to be a similar condition. The physician himself requested me to examine his wife thoroughly, which was done. While I found nothing especially wrong, her tonsils looked rather suspicious, and I told the physician they should be removed on general principles. The patient gave the history of having had a cough for ten years, and stated she had been treated by physicians in New York, Philadelphia, Chicago, and other places without benefit. Operation disclosed a pocket of pus about the size of a pea in one of the tonsils. Within three months her cough had entirely disappeared and she has remained well.

CASE V. Mrs. J., aged 56, was referred to me by Dr. C. for "throat trouble" which had been diagnosed by two or three physicians as tuberculosis. She was so nervous while in my office that she could not remain quiet. She coughed almost constantly and said she had asthmatic attacks at night. Her tonsils looked suspicious and I advised their removal, to which she consented. She began to improve within three weeks and is now perfectly well. She has no cough, no asthma, she is no longer nervous, and weighs one hundred and fifty pounds.

In conclusion: I do not wish to create the impression that the removal of diseased tonsils, the extraction of dead teeth, or the straightening of a deflected nasal septum will cure every ill to which humans are prone, but I do wish to assert that if these simple operations are performed early they will oftentimes benefit if not entirely cure many disorders such as those I have mentioned in this paper.

#### TONSILLAR FOCAL INFECTION.

In properly selected cases there is no more ardent advocate of tonsillectomy than I, but I do believe the present wave of enthusiasm for seeking and eliminating focal infection has carried us too far in our war on the teeth and tonsils. None of us doubts the great source of evil in a diseased tonsil and conservative surgery would recommend its removal. But how often have disappointments followed this operation where improvement of an arthritis or other form of infection failed to take place? Is it not true that in most instances after the tonsil is removed, in good faith that it is the offending organ, the trouble is not improved?—W. H. RENDLEMAN in the *Journal of Iowa State Medical Society*.

## DIFFICULTIES IN THE DIAGNOSIS OF URETERAL CALCULI.

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For long it has been customary to associate certain well-defined regions of the body with diseases of organs at or near those regions, or to name certain areas likely to be involved as the result or reflex action or irritation. Thus, affections of the kidney or of the ureters are usually regarded as causing pain that begins in the loin, radiates to the lower abdomen, and thence to the genitalia or thigh. But medicine is no exact science where the symptomatology of the bedside coincides with that of the textbook. Frequently, the above picture of the course of the pain is entirely lacking and its place is taken by distress that is occasioned in the abdominal region.

When this abdominal pain is a conspicuous symptom in renal or ureteral affections, its presence is often misinterpreted. The pain complained of is not infrequently in the appendiceal region, or at the position of the gall-bladder, so that a diagnosis of appendicitis or cholelithiasis is often erroneously made.

In many instances of ureteral affections, there is no complaint of any definite radiation of pain, and in some cases the pain is not at all severe. These patients come to operation because of evident renal affection, or from certain urinary symptoms or as a result of some indefinite abdominal pain. Certain peculiar symptoms may assert themselves that have no bearing on the disease under review. The late John B. Murphy asserted that almost any pain in the abdominal or pelvic cavity could have its genesis in a ureteral calculus. At the Mayo Clinic, among a very large number of cases (reported by Braasch and Moore) eight patients gave a history of radiation of general abdominal pain without localization and with vomiting and intestinal spasm suggestive of abdominal obstruction. Of this number, three had been previously operated upon for intestinal obstruction. It is believed that this transference of pain, together with the intestinal symptoms, is due to reflex activity of the sympathetic intestinal mechanism. In twelve cases the degree of pain was secondary in importance to symptoms of gastric dis-



turbance. In these latter cases, the major complaint was directed to digestive symptoms: general nausea, epigastric distress, and indigestion. In all the cases wherein the patient declares that he can feel the passage of the stone from the ureter to the bladder what he experiences is undoubtedly the irritation of the mucous membrane that has been previously brought about by its laceration in the passage of the stone through the canal. A stone impacted in the ureter may remain there for many years. Usually there is but a single calculus, but there may be several.

There are many sources of error in the diagnosis and although the roentgen rays and other adjuncts to diagnosis are invaluable, there are to be guarded against fallacies that too often lead the clinician into grievous blunders.

As is natural much dependence is placed by some on the results of urinary analysis, but such results are often misleading and negative. It is usually set down in text-books that reliance can be placed upon the presence of blood cells and pus cells in the diagnosis of a calculus, especially in the presence of the usual associated pain; but, alas! too often both the classical symptoms and the blood- and pus-cells may all be absent. Again, slight lesions of the lower ureter may cause the presence of just such cells. Hematuria is not a constant symptom and, if present, may point to some other condition along the urogenital tract, especially kidney involvement of some kind, *e. g.*, calculus, renal thrombosis and embolism, malignant tumor, etc. But calculi, local tuberculosis, acute cystitis, and villous tumors of the bladder are the most frequent causes of hematuria, from *below* the kidney. Much reliance is to be placed upon the roentgenological findings, although the sources of error to be found through this valuable adjunct to diagnosis are considerable.

It must not be forgotten that the constitution of ureteral calculi are various and that the rays cast varying shadows depending upon the character of the salts making up the concretion. There are times when these salts are of such consistence that they fail to cast a shadow. Not infrequently an extra-ureteral condition is diagnosed from the plate as a calculus.

It requires much experience and skill in the field of roentgenology to offer a picture of clear definition in cases of suspected calculi. The technic must be perfect, the hardness of the tube must be carefully ascertained, and the operator must have the best judgment in interpretation of the plate. Much also depends on the size and the position of the embed-

ded calculus. In spite of all care and skill on the part of the roentgenologist, as well as the employment of the most improved technic, at times even large sized stones with sufficient density to throw clear shadows, fail to reveal themselves upon the sensitized plate. It is imperatively demanded that the rays be so directed as to exclude overlapping of the shadows of the pelvic bones; at times this is an almost impossible procedure. Small stones that have set up an inflammatory condition of the ureteral mucosa may so change the natural appearance of the part as to defy detection by means of the rays.

Ransohoff believes that it is a difficult matter to ray and interpret kidney and ureteral stones, and he says frequently he has found thirty or forty small stones in the pelvis of the kidney when several plates of the region revealed only three or four. He asserts that misinterpretation of shadows in the path of the ureter is so very common, even in the hands of the best *x-ray* operators, that he offers the dictum: "A shadow in the renal pelvis or in the track of the ureter can positively be looked upon as a stone in the urinary tract only when it is associated with other clinical evidence." Calcified lymph nodes, phleboliths, the thickened tip of the appendix, and buried sutures infiltrated with lime salts, after previous laparotomies, especially for appendicitis, have all been mistaken for ureteral calculi.

Ureteral calculi, except when in the lower part of the ureter, present no distinctive symptoms. At times when operation for renal calculus is negative, subsequent catheterization sometimes reveals the presence of a ureteral stone. When colic is present and persistent, there is likelihood of a ureteral calculus. When the lower part of the ureter holds the stone, vesical symptoms are most conspicuous long before the calculus has made entry into the urinary bladder.

Stones in the lower part of the ureter can, not infrequently, be felt through the vagina or rectum. As a routine practice in laparotomy, wherever possible, palpation of the ureter should be practiced for the possible detection of the stone. In one case on record\* the stone could be rolled under the hand on deep pressure in the inguinal region. Upon removal, the stone was found to be four inches long and one inch in diameter. The conditions simulating stone which may cause localized nodular change in the prostate, seminal vesicles and ducts, lessen the value of palpation.

In order to be appreciable through the vagina,

\*W. F. Braasch and A. B. Moore, *Journal of the A. M. A.*, 1915, lxx, pp. 1234-1237.



the stone should be at least a centimeter (two-fifths of an inch) in diameter\* and should be situated within or immediately adjacent to the wall of the bladder. Unless so situated, stones of even several centimeters in diameter will not admit of palpation.

In an elaborate study of the condition, J. Israel† asserts that he was enabled to palpate the stone through the vagina and rectum in thirty-nine per cent. of his cases. However, in a series of eighty cases, in only nine instances was it possible to detect the presence of the calculus through this method of palpation. In forty-eight of these cases the condition was encountered in the male, and of this number in only three per cent. could the stone be palpated through the rectum, showing that this method of diagnosis has decided limitations.

It is an axiom that the prognosis of a ureteral calculus largely depends upon its effect on the kidney. If the obstruction is sudden and complete, atrophy of the kidney, often without previous dilatation, will result. Sudden impaction of the stone is the cause of anuria. Ransohoff‡ asserts that a stone weighing but a grain and a half has produced death. Much depends upon the other kidney; and yet impaction of a calculus may cause a sudden fatal reflex anuria, as after a nephrectomy, when the remaining kidney has been found normal in every way. In the absence of anuria, the prognosis is more or less grave, depending upon the rapidity with which the stone passes, the pressure that it exerts upon the wall of the ureter, and subsequently upon the peri-ureteral tissues. A stone impacted in the ureter may produce a fatal issue in a few days from the presence of anuria.

As a résumé of this subject, we subjoin a few thoughts from the elaborate and painstaking paper of A. B. Cecil,§ who bases his conclusions upon a study of 300 cases of renal and ureteral affections, grouping together 67 cases of stone in the kidney and the ureter.

He finds the condition is most common between the thirtieth and forty-fourth year, and found a ureteral calculus in a child of ten. Three patients between the ages of sixty-five and sixty-nine suffered from the affection. In seven cases of the 67, the urine was negative. In 56 cases blood was found, and in 54 cases there was found varying quantities

of pus. In 14 cases the urine was found to be infected. In 30 cases there were bladder disturbances varying from mere frequency of urination to intense pain and tenesmus. Rectal tenesmus was a prominent symptom when the calculus occupied the lower part of the ureter. In all this series of cases pain was present and it was on this account that the patients presented themselves for treatment.

In 28 per cent. of these cases only *abdominal pain* was present. Pain in the loins and in the genito-urinary areas and along the thigh was absent. In this 28 per cent., 7 patients complained only of pain in the left lower abdomen, 6 in the right lower abdomen, 1 in the left upper abdomen, 4 in the upper right abdomen, and 1 in the epigastric region.

The pain in the lower abdomen and on the right side was always experienced at McBurney's point, and in a corresponding position on the left side. The distribution of pain in the upper abdomen was just beneath the border of the ribs, at about the mammary line or a little mesial to it.

The confusing nature of the abdominal pain in cases of stone in the ureter is well illustrated when it is stated that in 13 of these cases various surgical measures were instituted. These included 9 appendicectomies, 1 operation on the left epididymis, 2 abdominal explorations, 1 gall-bladder drainage, and 1 removal of the right ovary.

In addition to the 13 cases in which operation had been performed, and in which operative procedure had been directed to other than the seat of the trouble, there were 8 cases in which stone had not been diagnosed and in which a diagnosis of appendicitis had been made in 5 cases, gall-stones in 2 cases and ptomaine poisoning in 1 case.

It was found that pain in the renal region of the back, or high up in the abdomen, is often indicative of stone in the lower part of the ureter; also that the stone may give pain which is limited to the lower abdomen, and which may be virtually limited to the testicle.

At the Mayo Clinic up to June, 1915, 134 cases of ureteral stone were found in the left ureter and 144 in the right, showing no special predilection. Single stones were found in 261 instances and multiple stones in 17 cases. In 6 cases stones occurred in both ureters; in the kidney of one side and the ureter of the opposite side, in 11 cases; bilaterally, in 17 cases, or 6 per cent. Stone occurred in the kidney and ureter of the same side in 12 cases, or 4 per cent.

218 SOUTH FIFTEENTH STREET.

\*Ibid.

†Jacob Israel, "Über Operationen wegen Uretersteinen", *Folia Urologica*, 1913, vii, p. 1.

‡Joseph Ransohoff, in *Keen's Surgery*, vol. iv.

§Arthur B. Cecil, *Journal of the A. M. A.*, lxxv, p. 19, Nov. 6, 1920.



## PRIMARY SARCOMA OF THE GALL-BLADDER.

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Primary sarcoma of the gall-bladder is extraordinarily rare. The most common tumor is the carcinoma.

Of 3,908 operations on the gall-bladder and biliary passages, cancer was found in 85, or 2.1% (Mayo). According to Musser, it is more common in women (3 to 1), and in 75% of the cases, gall stones are or have been present. The fundus of the gall-bladder is usually attacked first.

Ringel reported (1899) a papilloma of the gall-bladder. Griffon and Segall (1897) reported a case of sarcoma of the gall-bladder and liver. Nevaydonski (1900) reported a case of primary sarcoma of the gall-bladder and diffuse sarcomatous infiltration of the serous coat of the abdominal organs.

Sutherland's (1898) case was an adenomyoma of the gall-bladder. After a review of the literature, I confess I have been able to find only about 16 authenticated and accepted cases of primary sarcoma of the gall-bladder. There are, no doubt, a number of scattered cases in the literature, which I have overlooked. Then, again, the diagnosis, even at operation, may be wrong in some cases of supposed primary carcinoma of the gall-bladder. At times the resemblance between sarcoma and carcinoma is a very close one.

Iwasaki (1914) was able to find only 8 authentic cases, and reported one of his own.

Carson and Smith (1915) reported a case of primary sarcoma of the gall-bladder in a woman, aged 38 years, at the St. Louis Mullanphy Hospital (May 14, 1915). No tumor was felt. X-ray examination was negative. No other tumor tissue was present, except that in the gall-bladder. The liver was somewhat enlarged, but normal. Calculi were present. Cholecystectomy was done, and part of the liver invaded with tumor tissue was removed. The patient died four days after operation. A large irregular tumor, 8.5x4x3 cm., was found occupying the central part of the gall-bladder. It was a round-cell sarcoma.

Iwasaki's case showed a sarcoma of polymorphous character, 10 cm. x 4.5 cm.; and was composed of long spindle-cells, large round cells, small round cells and many giant cells.

Bayer (1909) reported two cases. One was a spindle-cell sarcoma with multinucleated giant cells; the other was composed chiefly of spindle-cells, although in some places round cells were also present.

Landsteiner (1907) reported 2 cases of myosarcoma of the gall-bladder. The predominant cells in both tumors were of the spindle-cell type. In one of his cases there was also an epithelioma in the gall-bladder wall in addition to the myosarcoma. One of the sarcomas reported by Landsteiner was 19 x 4 x 8 cm. and in one of his cases there were hyaline connective tissue changes which went on to calcification. A similar cartilage and bone formation was present in one of the (second) cases reported by Bayer.

Hotes' and Parlavocchio's cases were spindle-cell sarcomas of the gall-bladder.

Carson and Smith report their own case and mention Iwasaki's case, 2 cases reported by Landsteiner, 1 by Hotes, 2 by Bayer, and Parlavocchio's case.

In all the cases collected by Iwasaki, gall stones were found except in one. Metastatic growths were present in nearly all the cases reported.

In Landsteiner's case the secondary nodules were as large as 10 cm. in diameter, and the duodenum was involved.

In Hotes' case the appendix, spleen, pelvic and mesenteric glands, the diaphragm and the duodenum were involved.

Cathcart, before the Southern Surgical and Gynecological Society, in 1911, reported a case of primary sarcoma of the gall-bladder found at operation in a man, aged 45 years, fairly well developed, but with a slightly cachectic or septic look. Its surgical interest is only that the patient is alive and in good health, doubtless due to operation at an early stage.

Sarcoma of the gall-bladder, says Mayo, is exceedingly rare. Musser found 3 cases reported in the literature. "The disease may be looked upon as a surgical curiosity and has no apparent etiologic relationship to gall stones." (Mayo.)

Musser collected 100 cases of carcinoma of the gall-bladder, and 18 of the bile ducts. Of the 18 cases of Musser's series, only 3 showed in the hepatic duct (see my case report of John Y.), 14 in the common duct, 9 of these being at or near the papilla.

Rolleston in 17 cases of cancer of the bile ducts, found 2 in the hepatic and 15 in the common duct, of which 10 were at or near the papilla.

Courvoisier (1890) found that in 74 out of 84



cases of malignant disease of the gall-bladder there were gall stones. Siegert (1896) states that in 95% of all cases of primary cancer of the gall-bladder, gall stones are present. Only 15% of secondary cancer of the gall-bladder is associated with gall stones. Beadle, of London, found gall stones in all the cases of primary carcinoma of the liver and gall-bladder, and gall stones were not found in a single one of the 26 cases of secondary carcinoma of the liver. Kelynach, in 4578 autopsies, found 8 cases of primary cancer of the gall-bladder, only 2 having origin in the common bile duct. My case was a primary cancer of the hepatic duct, extending into the fissure of the liver.

I was able to find 16 cases of primary sarcoma of the gall-bladder, recorded in the available literature of the world. In a recent paper on "Primary Sarcoma of the Liver" (International Clinics, Lipincott, Philadelphia, June, 1921) I reviewed 59 cases of primary sarcoma of that viscus. It is, therefore, advisable that all discovered cases of sarcoma of the gall-bladder and liver be reported, as they are very rare.

I wish to express my thanks to Prof. Allen J. Smith for the privilege of reviewing the autopsy records of the University of Pennsylvania, for assistance given, and for permission to make notes from the records.

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#### A PLEA FOR PRE-SURGICAL DIAGNOSTIC ACCURACY.\*

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DETROIT, MICH.

A plea for an ideal state preconceives a criticism of the conditions that prompt it, and likewise, axiomatically speaking, the recognition of the need for a plea, involves also the recognition of the need for a criticism. To be over-sanguine, and consciously content with our work at any time, is indicative of mediocrity or retrogression, and in the realm of medicine and surgery it is particularly a pathognomonic sign of approaching decadence, if not an actual loss of vital interest in the whole of the altruistic, scientific progression of the profession.

It can be safely conceded that self-satisfaction is a prevalent disease, protracted in form, yielding sluggishly to inspirational stimuli. It can be classified as a type of psychological sleeping-sickness, sporadic in all professions, and endemic among medical men. This, as a broad criticism, covers a great multitude of our remedial sins, both of commission and of omission, and is, after all the basic fault that runs trickling under the structure of our scientific edifice, threatening to bring it down about our ears with rude awakening.

Ignorance is forgiveable, the weakness of false pride is not. To make a "snap" diagnosis is not necessarily a crime, but to arrogantly persist in maintaining an erroneous opinion in the face of overwhelming logic and an abundance of scientific proof to the contrary, often proves a grave, irrevocable sin,—grave, in both senses. I recall the case of a general practitioner of the old school of many years of so-called experience in a small town in eastern Pennsylvania. I happened to be visiting the place, and while there, one of its leading citizens was taken suddenly ill with severe abdominal pain, vomiting and

\*Read before the Maimonides Medical Society.



diarrhea. The leading physician referred to diagnosed acute indigestion and treated him with high rectal enemas and a restricted liquid diet. His drug therapy consisted of fractional doses of calomel and chalk. For about ten days the patient persistently refused to die in spite of the doctor's zeal. This case was quite easily diagnosed as a cholelithiasis with acute cholecystitis. The diagnosis was accurately established and logically proven, but our "snap-diagnostician" was as stubborn as Nero, and arrogantly played on the harp of his false opinions, even while his patient was being relieved of his calculi by appropriate surgery. Submission to reason is one of the highest evidences of a trained and honest mind. In this instance, both training and honesty were woefully lacking, and these examples can be multiplied, unfortunately, ad infinitum. Just one more illustration to illuminate the point in question. A married woman, 23 years of age, was submitted to double salpingectomy and appendectomy, by one of the numerous "haphazard" surgeons of this city. Forgive the unfortunate appellation, which, however, will bear the scrutiny of truth. About four or five days after the operation, complete paralysis of the bowels ensued with irrepressible vomiting. The surgeon in charge persisted in a diagnosis of newly formed intestinal adhesions and advised re-operation. Consultants logically pointed out a simple post-operative ileus, and advised against operation in the face of the patient's lowered resistance, shock, etc. Result: another Nero, another Rome, and a lamenting husband and child.

The doctor who practices his profession pseudoscientifically, is infinitely worse than the openly avowed "disciple of Mammon", quack or charlatan. The one is insidious, perpetrating his nefarious work under cover of darkest night, the other invites combat openly in broad daylight. Of the two evils, the latter is obviously the least. The honest practitioner need not be a "walking encyclopedia" of medical knowledge, nor an Osler in experience; his honesty is his patient's greatest source of confidence and safety. Greene put the matter very aptly when he said that "self-deception, a narrowed mental vision which disregards new facts of later development in the individual case and resists blindly the introduction of new methods in practice, no less than cowardly adherence to an erroneous preconception, are deplorable".

What applies to correct diagnosis in surgery, is even more specifically applicable in medicine. The

end-results of error, however, are far more visibly evident in surgery than in medicine, although the interrelationship of the two is so close that any sharp distinctiveness in their relative values cannot be made out. We have seen relatively uniform therapy or none, do for more than one zymotic disease long after the patient's recovery or otherwise; when the error or correctness of the diagnosis was subsequently cleared up. Whereas, one could open up a large pathological museum the size of our city hall with the normal appendices removed for "acute catarrhal appendicitis", or even for such a delightfully rare diagnosis as a Meckel's diverticulum. The long-suffering appendix has on innumerable occasions borne the burden of a simple enteritis or mucous colitis. Gall-stones, gastric, pyloric or duodenal ulcer, and the popular "indigestion", have long been mortal enemies in competing with each other for the first place in the diagnosis of epigastric pains, to the discomfiture of the honest practitioner, and the gloating glee of the avaricious know-it-all.

The diagnosis of pregnancy is ordinarily easy, but the greatest caution and inflexible honesty of investigation should be exercised, when a case, somewhat off the beaten path in character, presents itself, as for example, under the following circumstances. The girl was 14 years of age, attending high school. She had menstruated twice, and noticed about four months before examination, that her abdomen was slightly enlarged. There was a mass in the median line directly associated with the uterus. The diagnosis of fibroid or fibromyoma was made and the patient immediately operated upon. A five months pregnant uterus was found, and a history of contact was later secured. But the spot-light glare rested horribly on the practitioner whose case the little girl was. A painstaking investigation, a mind honestly and scientifically bent, would have avoided shoals of misery. And what is more regrettable is that these experiences when viewed with a biased and smugly satisfied mind, are repeated over and over again. No mental development or knowledge is derived from them, and the same dire misfortunes recur with alarming regularity.

To be critical of ourselves, is to be optimistic; to be optimistic means that we are always ready to learn—to reconstruct ourselves and our methods, so that the greatest good can come from efforts truthfully and intelligently directed, and that above all, dishonesty and stubbornness may find no place in our work.



## THE RELATION OF PYLORIC RESISTANCE TO THE RECURRENCE OF STOMACH ULCERS.

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Since it is known, from animal experimentation, that ulcers of the stomach may be produced by various methods and means, it cannot be said of any given, spontaneous ulcer, that it is the result of any particular etiological factor.

No matter what the means made use of, experimentally produced ulcers of the stomach in animals do not behave like those arising spontaneously within the stomach of man. This is as true of the ulcers systematically produced as those produced by direct local attack.

The difference in ulcers of the stomach that may be traced to some focus of infection, and those experimentally produced by the hypodermatic injection of infective microorganisms, would be that of the laboratory-created as against those organisms that were cultured around decayed teeth or tonsils, or any focus. Microorganisms of laboratory birth are the aristocrats of their kind. Their environment is that of ease and luxury. Those of the poorer class having to live in their chance foci must, in order to survive, wage an eternal battle against the tissue they have invaded. To this may be added the handicap of the natural immunity that is enjoyed by most experimental animals toward localized or focal infections.

Believing, as we do, that ulceration of the stomach is a symptom rather than a disease itself has lead many to think it was the reason for the ulcer's tendency to recur, but when recurrence did occur, and does occur after all perceptible foci have been removed, strong argument was made toward the existence of some other factor.

From their recurrence alone comes the quite general and prevailing opinion that such a thing as a medical cure for gastric ulcer does not exist. It is granted, however, that a small crater may granulate, cicatrize and remain so; but this we know to be the exception, for sooner or later, even following the most rational treatment, comes recurrence with a repetition of the original cycle of distress.

Why is this? Why is it that stomach ulcers that have healed are unwilling to remain healed? In seeking an answer to this question, it was but natural that no normal function of the stomach was included, and the valve-like action of the pylorus being a normal function it is not to be wondered at that no consideration was given it.

The following are a few of the alleged causes of recurrence that enjoyed popularity:

- Autocytolysis,
- Autodigestion,
- Post-digestive anemia,
- Traction on the scar by the peristaltic function.

Autocytolysis and autodigestion were said to go in unison because neither was capable of disintegrating the cicatrix until its physiological shrinkage had pinched off its blood supply. This opinion was given, notwithstanding the fact that the great majority of stomach ulcers occur in that portion of the stomach where the blood supply is the richest.

Prior to the splendid work of Rosenow and others, surgery used to be content to deal directly with lesions of this character; that a search for infective areas should be a part of the treatment was never so much as suggested, and yet, in the face of this sin of omission many lasting cures were effected.

Observing that recurrence was the great exception after gastro-jejunostomy, the notion went abroad that by virtue of this operation the gastric secretions were short-circuited into the jejunum and thereby being unable to come in contact with the eroded surface, recovery ensued without recurrence. When the ulcer was too high for a proximal gastro-enterostomy, excision was thought to be the operation of choice.

There are ulcers of the stomach the excision of which may be good surgery. We have in mind the ulcers that are low. Such, however, are the exception. If it was merely the crater with which we had to deal, the removal would, as a rule, be quite easy and free from untoward effect. It is the surrounding zone of callus that bids us beware, for it is not alone extensive but poorly adapted to safe suturing as well.

Confronting such a condition as the foregoing, nothing beyond the overcoming of the pyloric resistance is necessary. Here it is that we may remind ourselves that no matter what factors are involved in causing stomach ulcers to recur, that of pyloric resistance is the chief one. Remove it and the ulcer will not only heal but will remain healed.

We may now ask the question suggested by the title of our subject: What is pyloric resistance? How may it be overcome?

In attempting to answer these questions we may make more clear the thought we have in mind by briefly referring to what has been observed by physiologists relative to the valve-like function of the pyloric ring. They say: When the contents of the



stomach have attained a certain degree of acidity, the acid stimulus reflexly causes the pyloric sphincter to relax and admit a portion of the acid chyme into the duodenum; when a given amount of the acid chyme has entered the duodenum, a reactionary stimulus is produced and the sphincter again closes, to remain so until the duodenal content becomes neutral or alkaline. Thus is the pylorus opened and shut till the stomach has been completely emptied.

In this may we find a clue to the cause of that increased gastric motility observed in association with hypochlorhydria and at the same time remind ourselves that but very few ulcers of the stomach have been recorded in the presence of low or negative acid secretion.

We must not be surprised, then, in finding hyperchlorhydria given among the etiological factors of gastric ulcer, and while it cannot be gainsaid, observations of surgery would compel the belief that hyperacidity could play no part other than an indirect one, because when absent the pylorus is continuously patent and ulcer but seldom observed.

Before the Surgical Section of the American Medical Association in 1915, W. J. Mayo described an original method of excising ulcers from the stomach's posterior wall through an incision in the anterior wall. Later we undertook to apply the method but upon making the incision an ulcer was exposed with so wide a zone of callus that it was deemed best to immediately close the cut, perform a gastro-jejunostomy and await a future time for the resection. Eleven weeks subsequently, the patient reluctant, the second operation was undertaken. Upon exposing the interior of the stomach no part of the callus could be seen and the ulcer, the crater of which was once large enough to accommodate a quarter, was found shrunk to an insignificant linear scar, the mucosa, to all appearance, restored to a normal condition. With this case the repair was so complete that resection was not necessary. It is now more than five years since the gastro-jejunostomy was performed and at no period of this time has the slightest sign of recurrence been manifested.

Pyloroplasty or resection of the ring itself will overcome the resistance fully as well as a gastro-enterostomy but such a method cannot be encouraged if we believe all that has been said concerning the cause of duodenal ulcer. It is when we remember that duodenal ulcer usually affects the portion proximal to the papilla of Vater that we must concede gastro-jejunostomy to be the method of choice.

## PLASTIC AND COSMETIC SURGERY OF THE HEAD, NECK AND FACE.

GUSTAV J. E. TIECK, M.D., F.A.C.S.,  
and H. LYONS HUNT, M.D., L.R.C.S.,  
NEW YORK CITY.

### WOUNDS.

By H. LYONS HUNT.

More in plastic procedures than in any other branch of surgery are the kindly healing and coaptation of wound edges of great importance. This is particularly so of the face and neck, where unsightly scars are a constant and too obvious reminder to the surgeon, the patient, and all those with whom he comes in contact, of past careless or unfortunate surgical treatment.

For purposes of classification we may divide wounds into

- (a) those produced surgically.
- (b) those produced accidentally.

The latter wounds may be subdivided into: Contused, incised, lacerated, open, perforating, punctured, "paraffin"—all of which may be aseptic or septic.

### SURGICALLY PRODUCED WOUNDS.

In cosmetic and plastic surgery of the face and neck the resulting cicatrix is of prime importance. To avoid scar formation or, rather, to produce a minimum scar, certain fundamental principles must be adhered to:—

- 1—Incisions should be made with a razor-edged oblique-cutting blade.
- 2—Asepsis must be scrupulously observed.
- 3—Incisions should be made with sincere regard and respect for Langer's lines of cleavage of the skin.
- 4—The length of the edges of wounds should be the same, if possible, on each side.
- 5—Tension should be avoided.
- 6—Subcuticular sutures of horsehair constitute the best suture material.
- 7—Sutures should be removed within twenty-four hours.
- 8—A dry dressing and ice cap should be applied for the first day following operation. After the first day wounds should receive no dressing.

To use an ordinary sharp scalpel on the face is to invite a scar line. This even proves the case when the operator tries to incise the skin obliquely, a most necessary procedure. When a straight-bladed instrument is used slanting'y an irregular line of incision is produced and to avoid this I have had made



a knife which when drawn straight across the skin divides it obliquely. (Figure 1.)

The importance of cutting through the skin obliquely to avoid subsequent scar formation cannot be too strongly emphasized. Such an incision



Fig. 1. Author's slant-cutting scalpels. means an overlapping of the dermis of one border of the wound by the epidermis of the opposite edge. (Figure 2.)



Fig. 2. Skin cut obliquely with author's knife, showing epidermis overlapping the dermis of the opposite side of wound.

Infections about the face and scalp spread with great rapidity and for even minor surgical pro-



Fig. 3. Langer's lines of tension.

cedures in those regions, I am in the habit of carrying out all the general principles of sterilization involved in an abdominal major operation.

Where cosmetic results are an essential a careful study of the lines of skin tension should be made by the operator. Incisions crossing these lines instead of along them, will of a certainty be followed by wider scars than if care were taken to incise in the direction of tension. (Figure 3.)

To effect equal length of opposing wound edges is of course not always possible, but its accomplishment eliminates much that is unsightly in a resulting scar. Because it is so easy to believe that the opposing sides of a wound appear to approximate after sutures have been inserted, it has come about that not sufficient care is given this point. A very good example of this is seen in operations on the lower



Fig. 4. Diagram showing the impracticality of attempting to suture adjacent edges of a wound of unequal length.

eyelid where sections of skin are excised to remove redundant and baggy tissue. If the reader will refer to figure four he will observe that the line AB is much shorter than the line ACB, and while the two edges may be brought into approximation, the resulting scar would be unsightly. To avoid this I use a wound approximation clamp (figure 5). This instrument is used to draw together the fold of skin

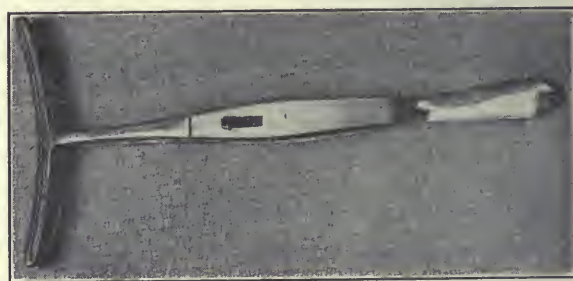


Fig. 5. Author's approximation clamp.

to be excised. A groove in the instrument permits the introduction of a syringe needle for anesthetization of the tissue, after which an oblique knife made to fit the same groove is introduced and the skin between is divided.

When wound edges are not easy to approximate and undercutting of the surrounding tissue is ineffective, the operator must turn to various other means.

A V-shaped cuticular relaxation incision may be made towards the defect. The denuded tissue left by the relaxation incision may be allowed to granulate or be skin-grafted. When relaxation incisions are impracticable, French sliding flaps or one of the standard methods of Lisfranc, Szymanowski, Cole,



Dieffenbach, Burow, Davis, Guerin, Celsus, Ammon, Hasner, Jasche, Lexer, etc., as described in the text-books, may be resorted to, depending on the size and shape of the wound surface to be covered. Another method is illustrated in figure 6.

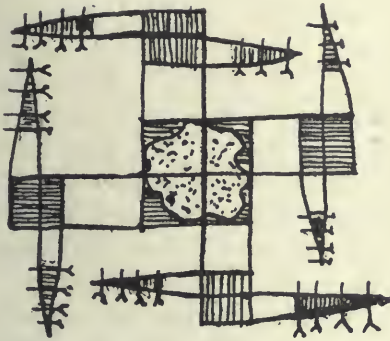


Fig. 6. Author's method of closing a circular, irregular or square defect.

Excessive tension must be avoided. Where a result is to be desired that can be produced only by much skin-stretching it is better to perform a series of minor operations, taking out at each a small parcel of skin, than to endeavor to gain an end at the expense of tension on the wound edges. For example, in eradicating the naso-labial delineation I repeat my operation at least three times, allowing a

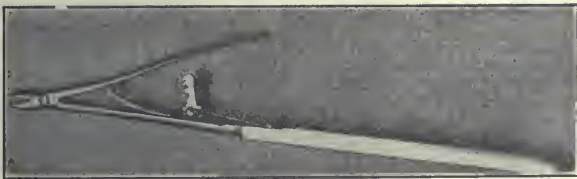


Fig. 7. Author's modification of Steven's ophthalmic needle-holder.

week between operations, and never taking out enough skin at any one procedure to produce marked tension.

#### *Sutures and Suture Material.*

I favor horsehair, silkworm-gut and catgut in all plastic procedures where a cosmetic termination is to be attained. If muscular tissue or fascias have been incised I use subcuticular muscle sutures, bringing the end of the silkworm-gut up and out through the skin at the two wound ends.

The early removal of the sutures—especially the skin sutures, and the subcuticular suture for deeper structures—leaving all the tissues free of foreign material, eliminates to a large degree superficial and deeper wound infections.

Immediately following face, neck and scalp operations, the wound is painted with a solution of iodine

followed by alcohol and peroxid of hydrogen. This renders the wound and surrounding field free from blood clot, and aseptic. The wound is next dried and a dusting powder of aristol and powdered pancreatin is applied along the wound edge and a strip of iodoformized gauze placed along the wound, lightly attached to the wound ends and adjacent skin with collodion. An ice-bag is prescribed for the first twenty-four hours. At the end of this period the



Fig. 8. Richter's clip applicator.

light gauze dressing is removed and no further dressing is permitted, the wound being exposed to the air.

There are many details of technic that bear a direct or indirect relation to cosmetic results. In all plastic work, I use needles of the smallest practicable size. Corneal needles, sizes Nos. 3, 4, and 5, I use with horsehair for skin and mucous membrane work. In mouth and cleft palate operations, either the French cutting needle or Lane's small cutting needles are useful. For long incisions, an ordinary round,



Fig. 9. Author's method of inserting subcuticular suture in a long wound.

straight, domestic sewing needle may be utilized. These needles being all exceedingly small require a needle-holder, and for this purpose I use a Steven's ophthalmic needle-holder which I have modified so as to prevent the needle slipping slantwise, as it occasionally does with other holders. (Figure 7.)

Leaving dead space below the skin or fascia should be avoided and where foreign matter, e. g., paraffin, has been removed, it is advisable to transplant fat from the buttock or thigh under the skin wound.

In excising sections of skin, fascia or muscle, sections which would ordinarily be followed by great tension, it is advisable to reinforce the subcuticular suture by inserting steel clips. I use the Butler clip applied with a Richter clip forceps. (Figure 8.)



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, NOVEMBER, 1921.

#### FADS IN MEDICINE AND SURGERY.

As in many other human affairs—dress, ornamentation, sports, social functions,—there have always been fads, so, too, in the practice of medicine, as well as in the development of cults outside its pale, there have always been, and probably there always will be fads. In earlier days these were based upon pure dogmata or upon empiricism. Today they are rather the too enthusiastic, uncritical application of scientific—or, sometimes, pseudo-scientific—determinations. It is quite unnecessary to relate any of the many therapeutic fads in medicine or surgery that in days past, and for some of them not remotely past, have flourished for a time and then sunk into deserved neglect. It might, however, serve a useful purpose briefly to consider some of the fads that prevail today in medical practice. They are not by any means pure fallacies. Rather, they are, it must be admitted, the serious and usually sincere efforts to correct human ills by an application of certain truths—or half-truths—with more enthusiasm than judgment, without due scientific critique, indeed often without common sense.

*Psychanalysis* is a fad that, unfortunately, is not confined to medical practice or even to psychology. It has become also the *matinée indulgence* of irresponsible flappers, neurotic women and misbalanced men. The Freudian doctrine explains many morbid

mental states—ranging from unhappiness to the borderland of insanity—as resulting from subconscious repressions, which, in turn, arise from sexual traumata; it asserts that these repressions dominate the individual's emotions in his waking hours and are represented, symbolically, in his dreams; and its therapeutic application—psychanalysis, consists in inquisitorial séances to discover these repressions and "bring them to the surface." But, unfortunately, the mere discovery of these repressions seldom itself effects their cure, which, in fact, these long, intimate, often daily séances are apt to make all the more difficult. Indeed, many of the practitioners of psychanalysis appear to relish, rather the wallowing with their patients in these "sexual traumata," "symbolisms" and "repressions," than the common-sense efforts to cure them. All too often the female patient discovers—through the interpretation of the psychanalyst—that she has developed "affection" for him and has lost the love she fancied that she bore her own husband. This is a common experience which the psychanalyst lays, not as a fault to these intimate "analyses," but to the patient's unfortunate earlier sexual traumata and to mismating!

By the interpretation of fancied dream symbols, by the magnification and perversion of petty incidents, more than one patient has been persuaded of sexual incompatibility with his or her spouse, and more than once neurotic longings, or marital dissatisfactions that might well have been composed, have been made, by psychanalysis, to terminate in lasting unhappiness or in the divorce court!

Granting the elements of truth in Freud's psychology and granting that some skilful psychanalysts, by discovering the repressed state, the disturbing sexual or other influence, have sometimes guided their patients to a cure, nevertheless it ought to be recognized that, in the hands of some, psychanalysis is capable of much evil, that many of the patients who submit to it are distinctly harmed. By the frequent discussion of sexual feelings and practices and by the establishment of morbid introspection and analyses, their last state is made worse than their first. For them—often young, unmarried women—better results might be accomplished through simple common sense or even through Christian Science. Indeed, these are the loosely pivoted individuals who fly from psychanalysis to Christian Science, or vice-versa, and then to New Thought, and then to some other ism or cult, always seeking to fasten to something that will explain to themselves their own impulses and emotions, reaching out to stronger personalities for such regulation of their conduct and



such interpretation of their desires, as well-balanced individuals can order and explain for themselves.

All physicians practice "a certain amount of Christian Science" for those who need it, and every physician and surgeon does, or should, practice "a certain amount of psychoanalysis" to determine, for example, when abdominal symptoms are of psychic origin, to learn what purely mental distress, repressed or otherwise, is mimicking somatic symptoms and by this "certain amount of psychoanalysis" he may, with kindly common-sense, even guide his patient to a happier frame of mind. But this is a long jump from the "sexual trauma," "Oedipus complex," "libido," "repression," "symbolism," "sublimation" and all the rest of the abracadabra of the Freudian psycho-therapy in which today so many girls and young women are absorbed.

*Ductless Gland Therapy.* The functions of the so-called ductless glands have been a fascinating mystery. With changes in some of them—the adrenal, the thyroid, the pituitary—we know that certain diseases are associated, and we know also that administration of certain extracts from these glands produces some fairly definite physiologic results. We know, too, that the gonads possess an internal secretion, and that loss of these organs effects some varied phenomena.

On the basis of this meager information, and certain other observations not yet fully established, many enthusiasts have persuaded themselves that endocrinology is a well-nigh finished study. They assume to classify all individuals as of certain endocrine types, and many diseases and disorders as representing hyper- or hypo-activity of this or that ductless gland. They proceed blithely to the cure of these diseases and disorders by the simple expedient of administering by mouth various mixtures of glandular extracts. They do it with an enthusiasm that is as amusing as it is amazing, and their confident assurance is scarcely even ruffled by the timid suggestion that most of the extracts thus administered have no demonstrable action. Nor does it disturb their state of satisfaction to note—if they do—that some of the diseases they would treat by glandular extracts are the same diseases that other faddists would treat by extracting teeth!

Of the present day enthusiasm for gland-extract therapy, Harvey Cushing himself recently said in the *Journal of the A. M. A.*:

"It has been the experience of all time that the less one knows of a disease the more enthusiastically are certain therapeutic agents advocated for its cure, and I know of nothing com-

parable to the present furore regarding the administration of glandular extracts unless it be the plant pharmacology of the middle ages, based on the 'doctrine of signatures.' A patient is bilious—therefore he has some disease of the liver. The leaves of a certain plant resemble in their color and appearance the surface of the liver—therefore a concoction of these leaves is good for biliousness, and the plant comes to be called hepatica. But then, lest it may not really do this, we will add several other things to the concoction as well. This is about the basis on which glandular extracts are administered today. And it will be noted that most of them contain a certain amount of thyroid extract, which possibly is the only one of these substances having any definite action when given by mouth.

. . . . The Lewis Carroll of today would have Alice nibble from a pituitary mushroom in her left hand and a lutein one in her right and presto! she is any height desired."

*Focal Infections.* That occult tooth infections may, and sometimes do, cause obscure pains, and joint affections, appears to have been established clinically by competent reports of well-considered cases cured by the removal of such teeth or by the eradication of their infection. But that such treatment is more often disappointing than helpful must be clear to those who have seen many of the edentulated victims of this fad. How often patients suffering, for example, with a pain in the arm due to cervical rib, subdeltoid bursitis, luetic periostitis or a neoplasm, have been induced to part with some or all of their teeth, not as a last resort after painstaking effort to locate the cause of their trouble, but almost as the first therapeutic suggestion!

The removal of the tonsils as foci of infection is a less serious matter than the sacrifice of useful teeth. The individual is no worse off without them and, if they have been the seat of painful inflammations, he is better off. Tonsillectomy is, however, an operation that produces suffering for several days and it is by no means free from danger. Tonsils should not be removed—as they often are—as possible foci of distant infection unless they are demonstrably diseased and the cause of the distant affection is not otherwise explained.

Of veciculotomy for the treatment of "rheumatism" one hears less today than a few years ago.

"Focal infection" is a beneficent fad insofar as it urges the physician to seek the *cause* of symptoms; it is a harmful fad if it tempts him to overlook those causes in his eagerness to fasten guilt on the teeth.

*Vaccine Therapy* has a scientific basis in the specific reaction to certain microorganisms by the production of antibodies. As a prophylactic against



that disease, the injection of typhoid vaccines is thus specific. But therapeutically, the affections that will respond to vaccines are much more limited than is the enthusiasm with which so many employ them.

The "*Chronic Appendix*" (*sic*). Time was when kidneys that "floated" a bit unduly were tacked up (for a longer or shorter time) where the surgeon thought they might better be. Today the "chronic appendix" must answer as sinner for all the pains on the right side of the belly—and also for gastric vagaries for which, in truth, it is occasionally responsible.

Chronic appendicitis is a very real disease. Its manifestations are various, indeed, but they are quite definite. Mere dragging pains in the right iliac region, or momentary pains, without definite *attacks*, without vomiting, even if pressure in the region of McBurney's point is somewhat painful (try the left side also!)—these do not mean chronic appendicitis or even "chronic appendix." But the individual who has such fleeting, dragging or vague pains from time to time (usually disappearing when recumbent) and who, in an unguarded moment, is told that he has a "chronic appendix" is apt, sooner or later, to have that appendix removed—and to continue having his pains. Then he will be ready for the "focal infection"-ist, and after he has exchanged his molars for a set of rootless porcelains he will be ready for Christian Science, which, if his disturbance was a neurosis, will probably cure him.

Such pains may arise from a variety of causes—from a prolapsed kidney, from muscle strain (static or occupational), from constipation, from suggestion. The diagnosis "chronic appendix" is too readily made and too often wrong.

*Colonic Irrigations.* Certain advertising literature would have the laity believe that it is more necessary to wash out the lower bowel each day than to wash the superficies of the body. There are those physicians who seem to think much the same. They are focal infection-ists in a group by themselves, for they see at the root of bodily ills, not the tiny apical tooth abscess, but the toxins of intestinal fermentation. And so patients with nervous and other affections, day after day—until they weary of it—receive their matutinal, intestinal lavations. It's a harmless fad, at any rate.

It is interesting to speculate what scientific truths will be seized upon as therapeutic fads in the next decade. We suspect that studies in food deficiency diseases will furnish one of them.

## THE SEMI-CENTENNIAL OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

The annual meeting in New York, this month, of the American Public Health Association will be an event of significance and interest to the profession and to the public at large. It will mark the semi-centennial of the founding of the Association and, incidentally, it will pay tribute to its only living founder, Dr. Stephen Smith of New York, who in another year will celebrate his own centennial. The sessions will be at the Hotel Astor, beginning November 14. Preceding these, from November 8th-11th, a Health Institute, arranged by the Association in cooperation with about one hundred other organizations, and including about forty demonstrations, will exhibit established methods applied to various phases of public health work.

From November 14th to 19th there will be held at the Grand Central Palace, in cooperation with the Department of Health of the City of New York, a Health Exposition, by which the message of health is to be brought to the public. Such an exposition in Chicago last year drew an attendance of over one hundred thousand. It is also planned to publish a memorial volume that will be, in effect, a fifty-years history of public health. Dr. Lee K. Frankel, 1 Madison Avenue, is Chairman of the Local Committee. The JOURNAL extends greetings, and congratulations upon great accomplishments, to the Association, and to its venerable founder, Dr. Stephen Smith.

## Progress in Surgery

Selections from Recent Literature

H. Lyons Hunt, M.D., L.R.C.S., (Edin.)

Abstract Editor.

**Subluxation of the Shoulder—Downward.** FREDERIC J. COTTON. *Boston Medical and Surgical Journal*, October 6, 1921.

Cotton here describes a condition often mistaken for circumflex paralysis—the subluxation of the shoulder downward in cases of injury not from a single trauma, but from the weight of the arm made possible through gradual exhaustion of the muscles—primarily of the deltoid muscle. He has seen this occurring in case after case as a complication of shoulder and arm injuries, clearing up promptly if treated early. Neglected, it becomes a troublesome complication.

Many, evidently, of the cases ordinarily listed as circumflex paralysis belong in this group.

J. W. Courtney cleared up a puzzling detail some years ago, by demonstrating that altered electrical reactions, even a definite "reaction of degeneration," did not prove nerve origin of muscle paralysis and were in no sense a contradiction of direct mechanical action—of stretching of the muscle—as the origin of these paralyses, with the consequent displacement of the head of the bone downward.

The type case is of an uncomplicated fracture of the humerus in which the weight of the heavy and, perhaps, swollen arm, suspended—as in the routine treatment—by the wrist only, brings about a tiring-out of the supporting muscles and the gradual appearance of a downward subluxation.

In an injured arm treated with traction by the weight of the arm or treated by any method that does less than carry the full weight of the arm, if the muscles are not strong and if the arm is a heavy one, we may and often do see a stretching paralysis of the deltoid and supraspinatus muscles



that lets the head drop down. This is readily overlooked, but readily verified by finding a groove below the acromion to the outer side, often visible, always easily felt.

If nothing is done, the condition passes on to one of helplessness and stiffness, at first glance not unlike that of subdeltoid bursitis, particularly like the form complicated with supraspinatus rupture.

Treatment, after recognition of the fact, consists of early massage, and, just as soon as the main damage makes it practicable, exchange of traction for support, and effective support, of the whole arm. Unless too long a time has elapsed, such support with massage, gives a prompt result—relatively.

**Resection of the Knee** (*Note sur L'Evolution de La Resection du Genou*). G. PASCALIS. *La Presse Medicale*, August 27, 1921.

The author has had occasion to examine a large number of cases with resection of the knee and has especially noted those with poor results—non-consolidations and consolidations in a poor attitude. The factors favoring or working against a successful ultimate outcome he discusses in full.

Hyperextension is not the ideal method of fixation for a resected knee—*genu recurvatum* is very apt to occur. For complete fixation of the resected parts any number of apparatuses can be used. Training to walk without sparing the resected joint too much is very important—every articulation of the foot should be brought into play intentionally, the patient rising to his toes at each step. The resulting shortening deformity should not be corrected too quickly, since the pelvis and spine will compensate to a great extent and even minimize the deformity by the dipping of the pelvis. The author prefers a good amputation to a very radical unlimited resection, contrary to the opinion of many surgeons.

**Sclerosing Non-suppurative Osteomyelitis as Described by Garré: Report of Case, with Roentgenographic and Pathologic Findings and Review of the Literature.** S. FOSDICK JONES, Denver, Col. *Journal of the A. M. A.*, September 24, 1921.

Interest in the case cited by Jones, centers in (1) the rarity of the disease; (2) the unusually long period of the acute symptoms, manifested by pain and swelling of the soft parts; (3) the character of the fusiform osseous enlargement, resembling a sarcomatous bone, and (4) the pathologic findings from specimens made at the time of operation. The boy was 9 years of age. The disease had been of thirteen months' duration.

**Fractures of the Lower Third of Tibia and Fibula.** A. D. LAFERTE, Detroit. *Journal of the Michigan State Medical Society*, October, 1921.

Where both bones of the leg are fractured in the lower third, the fracture of the tibia is usually oblique and the lower fragment displaces posteriorly and externally, and even though we are able to obtain a reduction, it is almost impossible to hold it with the usual splints or plaster cast, for the reason that the obliquity of the tibial fracture offers little resistance to the displacement consequent to the muscle contraction.

To prevent this muscle contraction we must apply extension. The fracture is so low that it is impossible to obtain enough skin surface for the usual application of adhesive tape or glue, and even though we could attach extension in this manner, it would not remain secure long enough to hold the fragments in place, because it is a remarkable fact that union in this area is more indolent than in any other part of the body, due probably, to the lack of soft parts over the tibia.

In order, therefore, to present a surface sufficient for the traction, apply a plaster boot extending from the toes to the fracture line. First apply two pieces of felt, one-fourth inch in thickness; one over the dorsum of the foot extending from fracture line to toes and broad enough to cover both malleoli; the other, on the back, extending from fracture line to heel, this being wide enough to overlap the former, thus giving two thicknesses of felt over each malleolus. These pads may be covered with a few layers

of flannel bandages, over which the plaster is applied, and so moulded as to fit quite snugly above the ankle and rather free over dorsum and heel. When the plaster is sufficiently dry, a heavy piece of cotton bandage is looped about the boot in such a manner that the ends, which will be used for traction, will be given off one from the neighborhood of either malleolus. A Thomas splint is now applied which has been bent to about 135° angle at the knee, thus relaxing the tendo-Achilles, easier traction and consequently easier replacement of the fragments being obtained. The traction is applied in the usual manner, quite tight, but not extreme.

After about three days the muscle spasm will have been overcome and it will be well to check up with the x-ray. If adjustment is necessary it is easily accomplished by changing the line of pull. Thus, if the lower fragment is still posterior, move the traction bands forward, causing hyperextension of the ankle and consequent forward movement of the lower fragment. Conversely, if the lower fragment be anterior, move the bands backward causing flexion. If there be lateral displacement, tighten the traction band on the side to which you wish the fragment to move.

If the lateral displacement is extreme it is easily corrected by passing a band around the leg over the fragment to be moved, and tightening it about the lateral bar of the splint.

The boot and splint are used until such time that manipulation no longer elicits any mobility of the fragment. Upon removal, however, one will find that bending is quite easy. Nevertheless, the union is solid enough to prevent displacement and the usual plaster cast may now be applied.

The time necessary for the use of the boot and splint will generally be from six to eight weeks, while another four to six weeks in a cast is indicated before any weight-bearing it to be attempted. (Fractures in the upper and middle thirds of the tibia will become united in about half this time.)

**Report of a Case of Hepatoduodenostomy with Some Observations on the Lyon-Meltzer Method of Biliary Drainage.** ARTHUR D. DUNN and KARL CONNELL, Omaha, Neb. *Journal of the A. M. A.*, October 1, 1921.

This is an interesting report of the unique case of a woman who had had her gall-bladder removed, with destruction of the common bile duct, upon whom numerous operations, finally successful, were performed to drain abscesses beneath the liver and to reestablish bile flow from the liver to the duodenum.

Several attempts were made to reach the hepatic ducts, but each time on dissecting beneath the liver, the patient became moribund, necessitating artificial respiration by oxygen insufflation and cardiac massage, followed by intravenous digitalis and glucose medication. Each attempt resulted only in reestablishing bile drainage from the denuded liver edge. A few days after the last of these efforts, the field beneath the liver was freed and packed with petrolatum gauze preparatory to an attempt at hepatoduodenostomy. Six days later, after hard search, a shrunken hepatic duct was found to the right of the incisura of the liver. The duct was slit longitudinally to a distance of one-half inch, and a tongue of duodenal mucosa was anastomosed to duct mucosa three-fourths the way around the slit, which was spread and held open by suture to Glisson's capsule. The hole in the duodenum from which the tongue was lifted was then sutured to a catch basin about 1 inch in diameter, to the under surface of the liver, completing a hepatoduodenostomy after the Mayo method. This anastomosis was completely successful in reestablishing bile flow. Bile appeared in three days, and the anastomosis has continued to function up to the present, five months later. In dissecting free the duodenum, a fistula was established for duodenal feeding, of which incidental use has been made for studies in biliary secretion.

This case afforded opportunity to test the value of Lyon's deductions concerning the significance of "A", "B" and "C" bile, as drawn from the duodenum after magnesium sulphate instillation. Dunn and Connell conclude:

Experiments carried out on a patient without gall-bladder or common duct have shown that the assumption is not



necessarily true that the B, or dark, viscid fraction of the A, B, C magnesium sulphate bile sequence represents gall-bladder bile, and that localizing disease of the biliary tract on evidence afforded by the Lyon-Meltzer method of bile segregation is not justified. These observations indicate that the A, B, C bile flow sequences obtained in the case studied were due to the reaction of the liver to the presence of magnesium in the portal blood.

**The Prevention of Simple Goiter in Man.** DAVID MARINE, New York, and O. P. KIMBALL, Cleveland. *Journal of the A. M. A.*, October 1, 1921.

The ultimate cause of simple goiter is totally unknown notwithstanding a relatively large amount of study. The immediate cause is a lack of iodine. The enlargement, therefore, is a symptom and may result from any factor which increases the iodine needs of the organism, as in certain types of infection, or which interferes with the normal utilization of iodine; or it may result from actual experimental deprivation of iodine. After consideration of all the various substances, agents and theories that have been put forward as having a role in the etiology of goiter, Marine and Kimball state that at present we must fall back on the view that thyroid hyperplasia (goiter) is a compensatory reaction arising in the course of a metabolic disturbance and immediately depending on a relative or an absolute deficiency of iodine. No accomplishment in preventive medicine has a firmer physiologic and chemical foundation than that underlying goiter prevention. As the work of prevention is based on certain of these facts, the more important are reviewed by the authors. A milligram of iodine, given at weekly intervals, has been found sufficient to prevent thyroid hyperplasia in pups. If the iodine stored in the thyroid is maintained above 0.1 per cent., no hyperplastic changes, and therefore no goiter, can develop. The method as applied to man consists in the administration of 2 gm. of sodium iodide in 0.2 gm. doses, distributed over a period of two weeks, and repeated each autumn and spring. This amount of iodine is excessive, and far beyond the needs of the individual or of the ability of the thyroid to utilize and store it. One gram distributed over a longer period would be better. The form or mode of administration of iodine is of little consequence. The important thing is that iodine for thyroid effects should be given in exceedingly small amounts, and it is believed that most of the untoward effects recorded are due to the excessive doses employed, or, more concretely, to the abuse of iodine. The results of their two and one half years' observations on school girls in Akron are as follows: Of 2,190 pupils taking 2 gm. of sodium iodide twice yearly, only five have developed enlargement of the thyroid; while of 2,305 pupils not taking the prophylactic, 495 have developed thyroid enlargement. Of 1,182 pupils with thyroid enlargement at the first examination who took the prophylactic, 773 thyroids have decreased in size; while of 1,048 pupils with thyroid enlargement at the first examination who did not take the prophylactic, 145 thyroids have decreased in size. These figures demonstrate in a striking manner both the preventive and the curative effects. The dangers of giving iodine, in the amounts indicated, to children and adolescents are negligible.

**Dispersion of Bullet Energy in Relation to Wound Effects.** COL. LOUIS B. WILSON. *The Military Surgeon*, September, 1921.

The chief interest centers around the missiles of high velocity. Our experience with these missiles is almost all within the last fifty years. Such missiles as spears produce their fatal effect by hemorrhage. With the substitution in cartridges, first with the paper patches around lead bullets, and later with the discovery of smokeless powder and the introduction of nickel, low-carbon steel or bronze jacketed bullets, the rifle tube could be kept free of lead and powder residue. Calibers could be reduced and velocities increased to about 2000 f. s.

If a tomato can is filled with small marbles and a high velocity bullet is fired through it, the marbles will make dents in the can. If a can be filled with sand, and a similar bullet be directed through it, the exit hole would be big

enough to admit two or three fingers. If a can be filled with water and a bullet be fired through it, the exit side of the can will be torn out. Similarly, in bones struck by missiles of the same velocity, portions of bone of high density show less local scattering than those of lower density, the shafts of long bones less than those of the head. The writer's experiments are well illustrated.

**Phantasies of the Dying.** J. NORMAN GLAISTER, London. *Lancet*, August 6, 1921.

Death should be looked on as a normal natural process, like birth, and should not be dealt with as something inevitable and undesirable when coming at a proper age. The mental state of a dying person is frequently caused by their physical disease.

The inoperable cancer case, considering the usual physical pain of his disease during his wakeful hours, will have his dreams filled with dying during sleep. The instinct to accept death steadily grows stronger and he sinks into lonely phantasies as those about him refuse to consider, in his presence, the nearness of death.

The role of the doctor is to treat symptoms, to prolong life as far as possible and to relieve physical pain by morphine, thus thrusting him out from the company of living minds. The method advocated by the writer aims at providing human companionship up to the last moment of consciousness. It relieves fear by showing the desire to share the patient's dreams and phantasies and to accompany him as far as possible on his road.

An immense amount of skilled effort is directed towards the extirpation of malignant disease, to the great advantage of those patients who are cured as a result; but unhappily most of those attacked remain uncured, and to these we seem to be able to offer comparatively little that is of value to them. Has not the time arrived for a broad re-survey of the whole treatment of the inoperable cancer case? Operative procedures of great value for the prolongation of life and the relief of discomfort have of late been described, but in very many cases the patient cannot be given the benefit of such treatment because it is considered necessary to maintain the fiction that there is no question of cancer, or alternatively that the growth has been permanently disposed of by a previous operation. When cancer has been diagnosed the facts in their least painful guise ought to be laid before the patient, and this may be a mental operation of considerable difficulty. The patient and his medical attendant can then discuss adequately their plans for extirpating the disease, or failing that for making the best possible use of the remainder of life, with all the help that the surgeon, the radiologist, and the psychologist can give.

**Aseptic Nephro-Ureterectomy.** EDWIN BEER, New York. *Journal of the A. M. A.*, October 8, 1921.

The patient is placed in the usual lateral position and the kidney is exposed as in an ordinary nephrectomy. The ureter and pelvis are carefully freed from the vascular pedicle, which is securely tied. Then the ureter is bluntly freed (care being taken to avoid tearing the peritoneum) as far down as the fingers can reach. This is usually possible as far as the level of the crossing of the large iliac vessels; at times the dissection may reach even lower. In this dissection, the kidney may be dislocated to the upper recess in the depth of the wound, or it may be brought out of the wound altogether, to produce tension on the ureter and facilitate the dissection. The level of the iliac vessels having been reached, a long and heavy silk traction ligature is placed on the exposed lower ureter in the depth of the wound. If the kidney has been delivered, it is replaced in the wound and the wound is protected with pads, while the patient is lowered from the kidney bridge, the silk traction ligature being brought out over the patient's abdomen so that, during the next step of the operation, it is ready to serve the operator in the rapid identification of the pelvic ureter. Then the patient is turned almost on his back, and a small incision, along the outer border of the rectus muscle through its sheath, as for an extraperitoneal ureterolithotomy, is made. By intermittent traction on the heavy silk



ligature, the ureter is rapidly recognized and freed from its extraperitoneal bed down to the bladder, where, between two ligatures, it is severed either with a cautery or with a phenolized knife; then, by further traction on the silk ligature, the freed ureter is delivered from the lumbar wound with the kidney attached, the upper ureteral channels remaining completely closed throughout the operation. The small anterior incision is rapidly closed in layers with a small rubber dam drain in the lower angle. Having protected this second incision with gauze dressings, the patient is again rolled on his side, the kidney wound inspected to be sure that there is no oozing, and the lumbar wound closed in layers with tube or dam drainage, as indications suggest.

This whole procedure is remarkably simple. The ease with which the ureter is located in the lower incision by intermittent traction on the heavy silk ligature applied through the lumbar wound allows the operator to execute this step with rapidity and without any great difficulty, so that practically no additional risk is run by the patient. The extraperitoneal anterior incision along the outer border of the rectus through its sheath, is a practically bloodless approach and is very quickly executed. By the technic described, the whole suprapubic tract is removed unopened, and no chance of contamination of the retroperitoneal spaces is possible.

#### **Surgical Aspects of Abdominal Tuberculosis in Children.** W. E. LADD, Boston, Mass. *Boston Medical and Surgical Journal*, September 15, 1921.

Tuberculosis, abdominal in character, is as frequent in the first year of life as in any year up to twelve years. Raw milk is not a more frequent source of infection than any of its products. Most cases come through the intestinal tract. Although the disease is more or less chronic, the symptoms for which these children seek relief are in most cases acute and recurrent. From a study of all types of cases—a survey extending over a number of years—the writer, in summing up states that:

The diagnosis of primary abdominal tuberculosis in children is often difficult.

The variety of its types of manifestation had led to confusion in its treatment.

Hygiene, diet and out-door life is the foundation of all treatment.

In the stage of localized mesenteric adenitis, surgical incision is logical, successful, and probably prevents the other stages developing.

In the ascitic stage laparotomy with evacuation of fluid is to be recommended when the patient fails to respond to medical treatment after a reasonable length of time.

The prognosis in the extensive adhesive stage is poor with any treatment and operation is resorted to only for the hope of relieving obstruction, in which it has been occasionally successful.

#### **Cancer.** JOHN E. TALBOT, Worcester, Mass. *Boston Medical and Surgical Journal*, September 15, 1921.

A race that eats very hot rice suffers from cancer of the esophagus. Another race whose custom it is to wear a charcoal stove against the abdomen, suffers from cancer of the abdominal wall. In our own race we find labial epithelioma common among clay pipe smokers. From these three facts the author advances the theory that cancer is usually preceded by chronic irritation, if not caused by it. In chronic irritation there is a death of the surface epithelium taking place more rapidly than normally occurs; likewise there is abnormal activity of the germ cells. This is due to trophic nerve control of the germ cells. This trophic nerve control is in all probability one of the functions of the sympathetic nerve. The degree of malignancy of cancer may be attributed to the age of the individual and the potential power of the tissue involved. In youth there is a high degree of power of reproduction necessary for the development of all tissues. In old age the power is diminished as is the control of the trophic nervous system over cell-production—hence the frequent incidence of trophic ulcers in the aged and insane.

#### **Conditions Predisposing to Hemorrhage in Tonsil Operations, Contraindications to Operation and Prophylactic Measures.** JOHN F. O'MALLEY, London. *The British Medical Journal*, September 17, 1921.

This is a study of sixteen hundred cases seen during 1912 and 1913. The operation was complete tonsillectomy with the author's guillotine. Profuse hemorrhage is more frequent in adults and men lose more blood than women. Short-necked people bleed more freely than others. Females bleed more freely if operated upon during menstruation. Hemophilia, tonsillar fibrosis, suppuration, arteriosclerosis, aneurism, exophthalmic goiter, suprarenal, pituitary and heart disease are all factors favoring hemorrhage—and should be taken into consideration as contraindications to operation.

Calcium lactate, horse serum, human blood serum, hemoplastin, coagulose, adrenalin and pituitrin are all remedies to be tried.

#### **Hydatiform Mole, Chorio-epithelioma and Ovarian Lutein Cysts—Etiology. Clinical Aspects and Operative Reports** (*La Mole Hydatiforme, Le Chorio-épithéliome et Les Kystes Lutéiniques de L'Ovaire*). JEAN COTTALORDA, Marseilles. *Gynécologie et Obstétrique*, August, 1921.

The author has quite exhaustively surveyed the literature in reference to his subject and in addition has compiled 54 cases since 1913 in which there is good evidence that a hydatidiform mole had become transformed into a chorio-epithelioma. In 50% of cases on record hydatidiform mole preceded chorio-epithelioma.

Bilateral lutein cysts have been found in 59 per cent. of cases of mole and in 9.4 per cent. of cases of chorio-epithelioma, demonstrating therefore the close relationship of lutein cysts with mole and chorio-epithelioma. It is certain that in 9 per cent. of all mole cases there is a degeneration to chorio-epithelioma; it is therefore logical to assume that in the presence of lutein cysts in the ovaries, impending malignant degeneration should be suspected and a pan-hysterectomy be performed during the month after the expulsion of the mole unless the cysts show marked retrogression. In the cases of moles without the presence of these ovarian lutein cysts, curettage will usually suffice, but keeping the patient under careful watch is important. Hysterectomy should be performed at once if hemorrhage occurs or if cysts develop in the ovaries. A very complete bibliography follows the article.

#### **Torsion of the Fallopian Tube in the Eighth Month of Pregnancy.** (*Isolierte Stieldrehung der Tube in achten Schwangerschaftsmonat*). A. H. HOFMANN, *Zentralblatt für Gynäkologie*, August 20, 1921.

A woman of 27 became suddenly ill with abdominal pain, and vomiting. A tumor in the cecal region was found, a diagnosis of appendicitis made. At operation the right tube was found twisted 360°. It formed a cyanotic tumor the size of a goose egg. The ovary was normal. Ablation, recovery.

## Book Reviews

#### **Essays on Surgical Subjects.** By SIR BERKELEY MOYNIHAN, K.C.M.G., C.B., Leeds, England. Octavo; 253 pages; illustrated. Philadelphia and London: W. B. SAUNDERS Co., 1921.

This collection of essays by the famous English surgeon consists of nine addresses and articles that have been published in various medical magazines within the past decade: The Murphy Memorial Oration before the American College of Surgeons; The Ritual of a Surgical Operation; The Diagnosis and Treatment of Chronic Gastric Ulcer; Disappointments after Gastro-Enterostomy; Intestinal Stasis;



Acute Emergencies of Abdominal Disease; The Gifts of Surgery to Medicine; The Surgery of the Chest in Relation to Retained Projectiles; and The Most Gentle Profession, an address to nurses.

**The Oxford Medicine.** By Various Authors. Edited by HENRY A. CHRISTIAN, A.M., M.D., Hersey Professor of the Theory and Practice of Physic, Harvard University; Physician-in-Chief to the Peter Bent Brigham Hospital, Boston, Mass., and SIR JAMES MACKENZIE, M.D., F.R.C.P., LL.D., F.R.S., Consulting Physician to the London Hospital, and Director of the Clinical Institute, St. Andrews, Scotland. In Six Volumes, *Volume IV. Diseases of Lymphatic Tissue, Metabolism, Locomotory Apparatus, Industrial Disease and Infectious Diseases.* Imperial octavo; 938 pages; illustrated. New York, London, Toronto, Melbourne, Bombay: OXFORD UNIVERSITY PRESS, 1921.

As this volume contains thirty chapters, a summary criticism of each, as in reviews of the earlier volumes of this loose-leaf system is scarcely practicable. It reveals many of the virtues and some of the defects of the previous volumes. The opening chapter on "Hodgkin's Disease" by Longcope and McAlpin is all that can be desired. The discussion of the "thymus and status thymicolymphaticus" by Riesman, in nine pages, is fairly well done. The next chapter on "Disease of the Spleen," by Sailer, is painfully inadequate because limited to 26 pages; why so small a space should have been allotted to such a vast subject passes our comprehension. We trust that some of the more important diseases of this organ will be discussed more adequately in succeeding volumes. The chapter on "Gout," by Ailbutt in collaboration with Hopkins and Wolf, is a great joy. Such scholarship, such ripe observation, such clinical acumen! And all wrapped in that charming eighteenth century prose of which Sir Clifford is a master. Such prose is the delight and the despair of medical writers. "Diabetes Mellitus" by Joslin, is of course an able bit of work. Howard contributes five chapters on "Obesity," "Hemochromatosis," "Ochronosis," "Rickets," and "Scurvy," all of which are well written. We recommended especially the chapters on "Diseases of the Muscles" by Steiner, "Arthritis Deformans" by McCue, "Diseases of the Bones" by Locke, "Industrial Toxicology" by Alice Hamilton and "Typhoid Fever" by Miller. The remainder of the book consists of chapters on the infectious fevers and is satisfactory in every way.

**The Surgical Clinics of North America.** June, 1921. *Volume 1, Number 3.* Boston Number. Octavo; 346 pages; illustrated. Philadelphia and London: W. B. SAUNDERS COMPANY.

Like the two preceding issues of this first volume, this one is a good number. The clinics cover a great variety of surgical subjects, by many of Boston's best-known surgeons, well edited and well illustrated.

**Practical Chemical Analysis of Blood.** By VICTOR CARYL MYERS, M.A., Ph.D., Professor of Pathological Chemistry in the New York Post-Graduate Medical School and Hospital. Duodecimo; 121 pages; illustrated. St. Louis: C. V. MOSBY COMPANY, 1921.

The book affords a brief résumé of the newer chemical analysis of the blood. In separate chapters Myers deals with non-protein and urea nitrogen, uric acid, creatinine, blood sugar, carbon-dioxide-combining power, cholesterol and chlorides. An appendix contains a practical discussion of reports on chemical analysis of the blood, the estimation of total solids and total nitrogen, the phenolsulphonethalein test and simple methods of estimating the various chemical ingredients of the blood. Myers' discussion is practical and sound. Naturally, his own extensive and valuable work in this field forms a good portion of the text. In order not to confuse the reader, only one method for the determination of the above substances is set forth; this method, in Myers' opinion, is the most serviceable. On the whole,

the book can be recommended as a very practical guide upon the subject.

**Progressive Medicine.** A Quarterly Digest. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics, Materia Medica and Diagnosis in the Jefferson Medical College, Philadelphia; Physician to the Jefferson Medical College Hospital, etc. Assisted by LEIGHTON F. APPLEMAN, M.D., Instructor in Therapeutics, Jefferson Medical College, Philadelphia; Ophthalmologist to the Frederick Douglass Memorial Hospital and to the Burd School, Etc. *Volume II.* Octavo; 339 pages; illustrated. Philadelphia and New York. LEE & FEBIGER, 1921.

Coley opens the second volume of *Progressive Medicine* with a very valuable résumé of the year's progress in the management of hernia. Particularly worth while are the criticisms of Stettin's operation and the discussion of post-operative ventral hernia.

Wilensky covers the subject of the Surgery of the Abdomen with great carefulness, giving the abstracts and annotations on more than five hundred articles. The part which stands out particularly is a discussion of end-results of surgery as viewed from the standpoint of functional recovery, as opposed to the anatomic restoration. The portions devoted to shock, anesthesia, and pneumo-peritoneum reflect the greatest progress of the year.

The section on gynecology by Clark lays considerable stress upon the education of the laity concerning cancer. As is natural, a large amount of space is given to the discussion of radium in the treatment of carcinoma of the uterus, and the relative advantages of radium and x-ray in the management of myomata. Rubin's method of testing the patency of Fallopian tubes is given in extenso.

E. H. Funk presents a splendid compilation of the disorders of nutrition and metabolism, the diseases of the glands of internal secretion, and of the blood and spleen. He points out the principles of Von Pirquet's method of feeding in terms of "nems." The discussion of vitamins and of the various theories of causation of pellagra and scurvy is adequate in general. There is a conservatism that is commendable in the selection of articles treating of basal metabolism and the various endocrine disorders. Among blood diseases particular attention is devoted to pernicious anemia and leukemia.

The closing chapter on Ophthalmology by Charles is brief, but contains little evidencing marked progress in this branch of medicine.

**Mental Hospital Manual.** By JOHN MACARTHUR, M.R.C.S., Senior Assistant Medical Officer, London County Mental Hospital, Colney Hatch; Lecturer on Mental Diseases to the Northeast London Post-Graduate College. Duodecimo; 215 pages. London: HENRY FROWDE and HODDER & STOUGHTON, 1921.

A simply written, useful manual of directions concerning the treatment of the mentally afflicted in institutions. It contains copies of the blanks and records employed under the English law. The general plan outlined is of practical service for a medical officer gaining his first experience in the management of the insane.

**A Treatise on Cataract.** By DONALD T. ATKINSON, M.D., Fellow of the American Academy of Ophthalmology and Oto-laryngology; Life Member of the American Medical Association of Vienna; Member of the American Medical, the Southern Medical, The National Tuberculosis and the American Social Hygiene Associations, etc. Octavo; 150 pages; illustrated. New York: THE VAIL-BALLOU COMPANY, 1921.

This book is a well-illustrated but very incomplete and unsatisfactory review of the literature on cataract. It doesn't add anything to the subject and several of the statements in it are generally not accepted.



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## ISCHIO-RECTAL ABSCESS: ITS ETIOLOGY, AND A METHOD OF TREATMENT TO AVOID FISTULA AND RECURRENCE.

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The number of operative failures in the treatment of ischio-rectal abscess has tempted me to make a study of this subject in an effort to determine, if possible, the underlying cause. A careful review of a series of 90 such cases on the Second Surgical Division at Bellevue Hospital during the past three years has shown but a scant 25% of complete cures. By this is meant a complete return to normal bowel control with no remaining sinus. One case in this series proved subsequently to be an epithelioma of the anus; another terminated fatally from a gas bacillus infection; two were proven of tuberculous nature by tissue examination; and two others were complicated by diabetes mellitus. Many of the remainder gave histories of repeated operations for recurrent ischio-rectal abscess, but were otherwise favorable. Thus we find an unusually large number of unsatisfactory results. The common sequence of events is: the occurrence of an acute ischio-rectal abscess; operative incision; and then a long persistent sinus oftentimes complicated by recurrent attacks of acute abscess formation. This state of affairs in itself is sufficient apology for the complete discussion of a condition in which the number of failures was not appreciated until a careful review of the subject was undertaken.

In order to incite bacterial suppuration within the ischio-rectal fossa the organisms must be provided with a means of entry. Such does not exist under normal conditions. Text-books usually dismiss this point by stating that the abscess starts as a focus of suppuration within the fatty tissue of the ischio-rectal fossa, but do not explain the means by which the infecting organisms reach this tissue. There exists within the rectum an abundant bacterial flora. The terminal inch of rectum, known as the anal canal, is surrounded by two firm, tonically contracted sphincter muscles between which muscles there

exists a small but distinct interval. This interval is the weakest point of the bowel wall and is separated from the fatty tissue of the ischio-rectal fossa only by the tendinous insertion of the longitudinal muscle fibers. As pointed out by Goodsall, this interval becomes more pronounced with advancing age, probably due to prolonged straining during defecation. Thus may be explained the greater frequency of ischio-rectal abscess in the third and fourth decades.

Any mechanical factor that serves to cause a tear, laceration or punctured wound of the mucous membrane of the anal canal, even though this be but microscopic in size, opens the pathway of infection. It is only at the anal canal that the bowel is surrounded by a really powerful sphincter muscle and it is only through the anal canal that the most solid and traumatizing content of the bowel passes. Add to this the passage of an unusually large and hard scybalous fecal mass and we have conditions ideal for a rupture of the mucous membrane. It seems probable that such rupture may occur simply from sudden overdilatation of the bowel lumen, analogy to which is to be found in the urethral mucous membrane where minute fissures may result from overdilatation of its canal. Any sharp foreign body, once it has passed the pylorus, has every opportunity of successfully completing its course through the intestinal tract until it reaches and encounters the firm resistance of the sphincter muscles. The break in continuity of the anal mucous membrane having occurred, infecting organisms have but a short path to travel through the interval between the sphincter muscles to reach the ischio-rectal fat. This fat is of a very loose and easily compressible nature; like all fatty tissue, is low in its resistance to bacteria; and is subject to frequent trauma. It is surprising, indeed, in view of the undoubtedly frequent abrasions received by the anal mucous membrane, that abscess formation is not more common. Clinically, it is not an uncommon complication among patients confined to the hospital for some other debilitating illness such as influenza, pneumonia, etc., which leads one to assume that the factors of resistance and immunity play their part in lowering the incidence of the condition.



Other etiological factors act also by virtue of a break in the continuity of the anal mucous membrane. Among these may be mentioned inflamed or thrombosed hemorrhoids, rectal ulceration, polypi, neoplasms, etc. The rôle which they play, however, is not large, doubtless because each of these factors requires a given length of time for its development, during which time occurs localization of infection to the rectal wall itself by leucocytic infiltration.

In speaking of blind internal fistulae, Goodsall states that this variety is usually the result of puncture of the rectal wall by a foreign body, or of perforation due to ulceration and that the frequency with which the track from the internal opening passes between the internal and external sphincter muscles appears to be strong evidence that the majority of complete fistulae in ano are in the first instance of the blind internal variety. It is an accepted fact that all complete fistulae are preceded by abscess formation. Hence it must follow that the majority of ischio-rectal abscesses originate as potential blind internal fistulae, which in turn signifies entrance of infection through trauma to the anal mucous membrane.

The question as to whether bacterial suppuration may occur primarily in fatty tissue, as evidenced by the occurrence of ischio-rectal abscess following external trauma, is deserving of some consideration. Directly comparable to this clinical picture is the incidence of perinephric or retrocolic abscess following trauma to the loin. Braasch states that the existence of primary perinephric abscess has never been definitely established and is inclined to the belief that the infection in such cases is due to a rupture of the kidney even when there is no clinical evidence of such rupture. Other observers hold the belief that the infection takes place as the result of trauma to the nearby colon which permits the bacteria to gain access to the peri-renal fatty tissue. Therefore it would seem logical to conclude that the bacteria that cause an infection of the ischio-rectal fossa following local external trauma, gain their entrance into the fat through a simultaneous injury to the anal mucous membrane. Thus, reserving for exception, only those cases in which the infection is hematogenous, it can be stated that true ischio-rectal abscess is practically always secondary to a break in continuity of the anal mucous membrane. In fact, in the beginning, the process may be considered as potentially a blind internal fistula in ano.

As suppuration proceeds, the ischio-rectal fossa soon becomes distended with pus which early makes

its way to the under surface of the overlying skin because of the very incomplete stratum of deep fascia separating the fat of the fossa from the subcutaneous fat. The ease with which the ischio-rectal fat permits of compression by the developing pus accounts for the union that may take place within the anal canal at the site of original injury to its mucous membrane. There are undoubtedly but few, if any, symptoms of infections in this loose tissue for the first two days and there not infrequently elapse three to four days of abscess formation before the average patient considers his condition imperative enough to seek medical advice. This circumstance does not, however, relieve the operator's obligation to make every effort possible to determine the point of entrance of the infection at the time of operation.

The relation of tuberculosis to ischio-rectal abscess and fistulae in ano has long been a debated question. There can be no denial of the fact that ischio-rectal abscess may occur in a patient debilitated by pulmonary tuberculosis, just as it may occur during or after other illness; but such occurrence does not necessarily signify that the abscess is of a tuberculous nature. Walsham cites 891 cases of pulmonary tuberculosis under treatment for three years, among which there were only five cases of fistulae in ano\* and two cases of ischio-rectal abscess. Moreover, his autopsies upon 133 persons dead from pulmonary tuberculosis showed but one fistula in ano. Gant states that from 4%-6% of those affected with fistula in ano also suffer from tuberculosis. The point to be borne in mind, however, is not the number of cases of abscesses or fistulae that are present in tuberculous patients, or the number of persons suffering from abscess or fistula who are also afflicted with tuberculosis; but, the number of abscesses or fistulae out of a series of such abscesses or fistulae which are of themselves proven tuberculous by histological examination. As already noted, there were but two instances of tuberculous abscess in the series of 90 cases at Bellevue Hospital. A review of 72 cases of fistulae treated over the same period of time showed but one such to be tuberculous. These statistics, showing approximately 2% of tuberculous abscesses and fistulae, tend to lower still further the percentage customarily given.

Ischio-rectal abscess is not a life-endangering illness, but is worthy of far greater attention than it habitually receives. Two main objectives should be

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\*Inclusion of statistics covering fistulae in ano is permissible since this condition is dependent upon preceding ischio-rectal abscess.



kept in mind: First, to evacuate the pus and provide free drainage; and second, to determine, if possible, the point of entrance of the infection. The usual operative treatment consists of an incision or incisions into the most prominent portion of the abscess, evacuation of the pus and drainage, but no attention is centered upon the source of the infection.

To accomplish these aims the operation must be approached upon the scale of a major procedure. In preparation for this, castor oil catharsis is indispensable since through this agent not only is the intestinal tract thoroughly emptied but also there follows a period of 2-3 days during which defecation is not likely to occur. Two enemata of soapsuds in the evening of the day before operation will serve to effectually cleanse the rectum and anal canal. General anesthesia is the rule, with the patient in lithotomy position. Thorough manual dilatation of the sphincter muscles is absolutely essential to permit of inspection of the anal mucous membrane. This requires a full five to ten minutes of gradual stretching. A more rapid dilatation defeats its own ends since this practically always results in multiple lacerations of the mucous membrane which can but help confuse the operator. The anal mucous membrane is now carefully inspected and palpated to locate the point of entrance of the infection. This may show as a small but definite defect or as a local y indurated, inflamed area on the mucosa. If no such point can be found, the abscess is incised by an ample radial incision, hemostasis is attained, and the wound edges are separated by retractors. A second search for the point of entrance of infection is then made, using a small probe externally and the index finger of the unoccupied hand within the rectum. Oftentimes the defect in the anal mucous membrane will become apparent as a distinctly thinned out, deficient area or as a definite opening through which the probe will drop into the anal canal. Gentleness in the performance of this manipulation is essential to avoid making an artificial communication. Having thus located the involved area, the opening of the abscess is completed by a clean transverse incision through the external sphincter muscle continuous with the radial skin incision. As is well known, a single transverse division of this muscle, while it may cause a temporary diminution in the power of bowel control, is scarcely ever followed by permanent disability. During the operation a culture is made from the pus and a small section of the abscess wall is excised, the former for bacteriological, the latter for histological examination. The wound is packed to its

depths lightly with petrolatum-gauze and a dry dressing is applied.

In the event of inability to identify the point of entrance of the infection by either of the above procedures, the abscess is permitted to drain through the radial skin incision but exceptional care is to be taken with the post-operative dressings. The first dressing is done following the first bowel movement, usually on the third day of convalescence. The petrolatum-gauze is gently removed and the wound is irrigated. The index finger of one hand is inserted into the rectum and its mucous membrane palpated for any developing defect, while a probe may be used externally to assist in the search. If at any time one is thus able to identify the mucosal defect, it is recommended to the patient that he submit to operation for the more satisfactory opening of the abscess. He may be assured that without a second operation he has no more than 25% prospect of complete cure and that even though this be undertaken at a later date, division of the external sphincter muscle will undoubtedly be necessary. It is the constant post-operative contractions of the sphincter muscle which irritate and tend to prevent the process of healing in the tract through which the infection has made its way. It is only by division of this muscle that the parts can be put completely at rest, thereby creating the most favorable conditions for a permanent cure.

Opened and drained simply by a skin incision the abscess cavity will contract until but a small sinus remains. This sinus will persist because of its irritating surroundings and because of the fact that it continues to receive fresh infection from the rectum. Furthermore, with occasional occlusion of its external orifice, abscess formation may recur at varying intervals. For the average abscess the single radial incision will be found to give adequate drainage. Rarely is it necessary to add a second wound since, with a divided sphincter, no difficulty will be met in keeping the cavity open by a light packing of petrolatum-gauze. The unusually large abscess or the abscess involving both ischio-rectal fossae had best be approached with the understanding that it will more than likely require a second operation before obtaining a complete cure.

Elting states that the sphincter muscle need never be cut in dealing with the above conditions and performs his repair of a persistent sinus by dissecting back the rectal mucous membrane as far as the level of the insertion of the levator ani muscle if necessary, resecting the diseased mucosa, and suturing the



edge of healthy mucosa to the muco-cutaneous margin of the anus. Such operation, however, is open to the same dangers as the Whitehead operation for hemorrhoids, in addition to which it is more extensive than this procedure and difficult of performance with a friable, diseased anal mucous membrane.

Post-operatively it is unnecessary to administer any of the products of opium to induce constipation, for there will be no difficulty in this respect upon a diet with small residue. Moreover, it is desirable for defecation to occur on about the third day because by this time the feces will not have become so hardened as to cause undue trauma. At the time of the first bowel movement the gauze packing may be gently removed, the wound cleansed by irrigation, and fresh petrolatum-gauze introduced. From this time until the wound is nearly completely healed the dressings, than which the operation itself is hardly more important, must be done daily. In removing the drain, irrigating the wound, and re-introducing the drain, the utmost care is necessary to maintain adequate drainage and to avoid pocketing of any portion of the cavity. The wound must heal by granulation from its depths and the last point to close must be the anal mucous membrane. Daily hot sitz baths, when available, will be found a most desirable adjuvant to convalescence.

In concluding, I wish to express my appreciation of the generous assistance and constructive criticism given to me in the preparation of this article by Dr. John A. Hartwell, Director of the Second Surgical Division at Bellevue Hospital.

#### SUMMARY.

1. The origin of infection in ischio-rectal abscess is from trauma within the anal canal. The condition may be considered potentially as a blind internal fistula in ano with abscess formation.
2. Radial incision into the abscess with transverse division of the external sphincter muscle gives the best prospect of a permanent cure.
3. The tubercle bacillus is the etiological factor in no more than 2% of the cases.

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#### RELATION OF PULMONARY AND ANO-RECTAL TUBERCULOSIS TO FISTULA IN ANO.\*

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The relation between pulmonary and perianal tuberculosis to fistula in ano is a subject freely discussed by physicians, surgeons and proctologists in ancient and modern times and is not fully understood yet. Older writers believed all fistulae were tuberculous or, if not, that stopping the discharge would bring on pulmonary tuberculosis, skin affections or other serious complication, and they advised against their cure.

Fistula in ano may be associated with pulmonary tuberculosis, but this occurs less frequently than is believed by the profession. Again, most physicians and surgeons hold that the majority of anal fistulae are tuberculous, which is not true. Of five thousand fistulae examined and treated by me less than 10 per cent. were tuberculous. It is unfortunate that medical men regard the majority of fistulae as tuberculous, because some physicians consider such sinuses incurable, or hold that phthisis develops when they are healed and refuse aid to this class of sufferers, many of whom are curable by a local anesthesia five-minute operation.

It is difficult to determine the ratio between fistula and pulmonary tuberculosis because the victim of the latter seldom tells the family physician he has a fistula nor does the fistula patient, except when questioned, inform the surgeon he has a cough. The percentage of patients afflicted with lung tuberculosis suffering from fistula in ano varies from 1 to 30, according to statistics of institutions specializing in pulmonary tuberculosis.

A study of statistics compiled from several sanatoria for consumptives together with an analysis of my cases has convinced me that not more than 5 per cent. of individuals having pulmonary tuberculosis suffer from fistula in ano.

\*Read before the American Proctologic Society, June, 1921.



In this connection I wish to reiterate that fistulae are not a common complication of pulmonary tuberculosis and but a small percentage of fistulae are tuberculous.

From the viewpoint of time required for healing and their relation to tuberculosis ano-rectal fistulae may be subdivided into three groups:—

1. Ordinary fistula in individuals having pulmonary tuberculosis.

2. Tuberculous fistula in otherwise healthy subjects.

3. Tuberculous fistula in persons suffering with pulmonary tuberculosis.

Frequently individuals having lung involvement suffer with non-tuberculous sinuses that heal rapidly following operations unless the patient is already exhausted by lung or other complications.

Tuberculous fistulae that heal are occasionally encountered in persons having tuberculous foci neither in the lungs nor elsewhere, but considerable patience and ingenuity are required and it is unsafe to give an opinion as to the length of time it will take to cure them.

The most deplorable cases are those in which the patient suffers from pulmonary tuberculosis and primary or secondary tuberculous fistula, because the subject is so devitalized by double infection that healing of either or both lesions is frequently impossible. In this class of cases fistula is often connected with extensive tuberculous ulceration involving the rectal mucosa, sphincter or perianal skin.

Tuberculous ulcers and fistulae of the ano-rectal region may result from infection caused by *human* or *bovine* bacilli, but the former is responsible for infection in 98 per cent. of cases. Tuberculous fistula in ano may be primary or secondary, but in 95 per cent. the sinus is secondary to tuberculosis in other organs, usually the lung, and in 5 per cent. of cases the disease is primary, there being no connection between fistula and lung involvement. In patients having pulmonary lesions and a tuberculous fistula, the former usually shows first, but in a few instances I have treated tuberculous sinuses that preceded infection of the lungs or other organs, which indicates that infection elsewhere is sometimes secondary to ano-rectal tuberculous ulceration and fistula.

Tubercle bacilli apparently enter the blood or lymph vessels during or following operations on tuberculous fistulae, for joint tuberculosis has developed shortly following the laying open of sinuses.

*Symptoms.*—Early manifestations of tuberculous

fistula uncomplicated by lung involvement) simulate those of ordinary ano-rectal fistula, there is a discharge, discomfort in the rectum and irritation of the perianal mucosa and skin, but abscesses responsible for them take considerably longer to form, during which time suffering is appreciably less.

When the patient suffers from pulmonary tuberculosis and ordinary fistula or a fully developed tuberculous sinus, with or without ulceration, he looks tuberculous, and exhibits typical evidences of general tuberculosis—anorexia, great loss in weight, weakness, cachexia, afternoon rise of temperature, restlessness, night sweats, cough, discomfort in the chest, difficult breathing and occasionally extreme anemia due to hemorrhage from the lungs.

Some patients treated by me for tuberculous fistula in no way resembled phthisical subjects and the true character of the sinuses was not suspected until tubercle bacilli were discovered in the discharge, scrapings or wall of the fistula.

Some tuberculous fistulae are more malignant than others, and in one case resemble ordinary fistula and in another the tuberculous process extends in different directions from the tract, destroying the anal canal, sphincters, subcutaneous fat and perianal skin, forming a deep, broad, irregular ulcerated area or cavity likely to be confused with perianal epithelioma or ulcerative elephantiasis (*esthiomene*).

Tuberculous fistulous openings usually have irregular serrated, rounded, highly-colored borders, rarely sensitive to touch. They are seldom painful because of the large size of their internal and external openings from which pus freely escapes, forestalling distention and throbbing pain. The discharge from ano-rectal lesions and fistulae is abundant, thin, of a whitish hue and offensive odor.

*Diagnosis.*—Tuberculous fistulae are usually secondary to pulmonary tuberculosis, the result of swallowed tubercle bacilli that eventually reach and infect the rectum or perianal skin, hence most patients exhibit pulmonary manifestations. When in doubt as to whether or not a sinus is tuberculous the discharge, scrapings from the tract and sections from the fistula wall are examined for tubercle bacilli.

Where the patient is emaciated and coughs, the sputum is examined, and if tubercle bacilli are discovered there is reason for suspecting that the fistula is tuberculous, but it is well to bear in mind that ano-rectal fistulae may be primarily tuberculous and that patients afflicted with tuberculosis may suffer from ordinary or non-tuberculous fistula.

It does not follow that the tract is tuberculous be-



cause tubercle bacilli are discovered about the anal mucosa or skin, since these organisms are found about the anal region in the subjects of pulmonary tuberculosis having neither ano-rectal ulcers nor fistulae.

Smegma found in the preputial, external genital and ano-rectal regions closely resemble, and have been mistaken for, tubercle bacilli and a differentiation must be made when attempting a diagnosis in suspected tuberculous fistula. In doubtful cases of fistula in ano, the patient is subjected to the tuberculin test. Tuberculin reactions are of no diagnostic value when the patient suffers from pulmonary tuberculosis, since they point to a tuberculous condition, but do not indicate its location.

The points of differentiation between ordinary and typical tuberculous fistula are given in the accompanying table:

DIFFERENTIAL DIAGNOSIS BETWEEN TUBERCULOUS  
AND NON-TUBERCULOUS FISTULAE.

<i>Ordinary Fistula.</i>	<i>Tuberculous Fistula.</i>
Internal and external openings small, round and situated in the center of an elevation.	Openings large, irregular and have undermined purplish edges.
Buttocks plump.	Buttocks emaciated.
Hairs of peri-anal region normal.	Hairs abundant, long and silky.
No cachexia.	Cachexia.
Face, ears and nose unchanged.	Face pinched, nostrils dilated.
Voice natural.	Voice husky.
No loss in weight.	Marked emaciation.
Discharge slight, thick and yellow.	Discharge thin, profuse and whitish.
Probing difficult.	Probing easy.
Appetite normal.	Appetite poor.
Digestion good.	Indigestion.
No night sweats.	Exhausting night sweats.
Sleep natural.	Sleep disturbed.
No lung involvement.	Pulmonary lesions with or without hemorrhages.
Discharge contains colon bacilli, streptococci or staphylococci.	Discharge contains tubercle bacilli.
Tight sphincter.	Patulous anus.
Temperature normal.	Afternoon rise of temperature.

*Prognosis.*—The prognosis is fairly good for ordinary fistula complicated by pulmonary tuberculosis when the patient retains his vitality. Many tuberculous fistulae, uncomplicated by lung involvement and those complicated by pulmonary lesions where the subject is not greatly reduced, heal when intelligently operated upon and treated.

Tuberculous sinuses in otherwise healthy individuals and ordinary fistulae in tuberculous subjects heal slowly, and when improperly treated the patient gradually or rapidly declines and dies from exhaustion or complications.

*Treatment.*—Palliative measures are not curative,

but they keep the patient comfortable and strengthen tuberculous subjects for operation, or prolong life in inoperable cases. Palliative measures consist in enlarging fistulous openings, cleansing and draining the sinus, stimulating ulcers and prescribing salves, suppositories or dusting powders to relieve pain and ally irritation of the anal mucosa and skin. Patients having ordinary fistula and lung involvement, or a tuberculous sinus do better when the above measures are reinforced by open-air treatment, tonic emulsions, forced feeding, keeping the bowel open and having the patient abstain from exercise when running a febrile course.

*Operative Treatment.*—I no longer hesitate to operate upon tuberculous or ordinary fistulae complicated by pulmonary tuberculosis as do some surgeons who fear that lung complications or skin disease will develop, if the tract heals and the discharge stops.

The vitality of the patient determines whether or not an operation is indicated. I operate upon persons having pulmonary tuberculosis and ordinary fistula, individuals suffering from a primary tuberculous sinus and subjects afflicted with both pulmonary and perianal tuberculosis whose vitality is good; I have frequently cured these types of fistula and succeeded in fully restoring the health of this class of sufferers by sending them to the mountains where tuberculous foci in the lungs healed quickly, following elimination of the fistula.

Where two destructive processes are exhausting the patient, it is easy to understand why arresting one helps nature and treatment to overcome the other. Occasionally, primary and secondary tuberculous fistulae and ordinary sinuses in phthisical subjects are not healed by palliative or operative measures and the patient dies of phthisis or exhaustion from local lesions. Fistula patients are not operated upon by me when their vitality is low and healing could not be expected to take place.

Many apparently healthy individuals suffering from ordinary or tuberculous fistulae have latent tuberculous foci in the lungs and die shortly following operation, which is blamed for the fatality. I have never lost a patient under these circumstances except where the operation was performed under ether or other general anesthetic, which in my opinion irritated the lungs and incited the tuberculous process to renewed activity.

Ano-rectal tuberculous sinuses and the majority of ordinary fistulae in tuberculous subjects are readily operated upon under local anesthesia, since the



sinus is short and usually tracks through subcutaneous fat. Rarely deep and complicated fistulae requiring general narcosis are divided under gas, gas-oxygen or chloroform anesthesia, but never ether, which is unsafe in this class of cases since it aggravates pulmonary lesions.

Tuberculous sinuses are painless<sup>y</sup> operated upon in five minutes, following infiltration of the bridge of tissue overlying the tract with 1-8 per cent. eucain solution. After the sinus has been divided and its overhanging edges removed with knife, scissors or cautery, it is treated with phenol or cauterized to prevent extension by way of injured lymph- or blood-vessels and packed with gauze to control bleeding.

The *post-operative treatment* of tuberculous is about the same as for ordinary fistula wounds except that they require more stimulation and the patient is instructed to sleep with windows open, spend his time out of doors, drink plenty of milk and eat abundantly of eggs and nourishing food, for these sufferers never do well and frequently die when confined to bed in poorly lighted and ventilated rooms.

Before the advent of local anesthesia the *ligature operation* was resorted to in tuberculous fistulae, since it avoided a general anesthetic and placing the patient in a hospital, but the procedure has been abandoned because it is painful, several days are required for the ligature to cut out and results are not so good as when the tract is divided with the cautery.

Some surgeons *excise* tuberculous fistulae, but my experience has shown that the division operation is preferable.

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## TUBERCULOMA OF THE ISCHIO-RECTAL FOSSA. A CASE REPORT.\*

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I am reporting a case which carried with it more interest than the average proctologic case encountered in our practice. It was interesting because, first, we were mistaken in our diagnosis, second, the pathology was unusual, third, the source of infection could not be found, and fourth, since it required operative treatment, the necessity for a suitable scar was urgent. We were indebted to a local railroad surgeon for the opportunity of examining and operating upon his patient, who was a locomotive engi-

neer, fifty-two years old, of lanky, lean stature, but of normal weight.

Chief complaint.—Pain and tenderness in region of rectum, with a hard, smooth swelling which had appeared six weeks before, most likely more.

Present illness.—Patient was well until six weeks before. He first noticed a small, round swelling around the anus, which he ascribed to a slight wound received by sitting on a tack in the seat of his engine cab. The swelling continued to increase in size and tenderness until he could no longer follow his occupation. The treatment dispensed by the company surgeon did not benefit him. On account of the density of the lump, the surgeon suspected some bony formation arising from the ischium, and roentgenograms were made. These revealed no defect in the pelvic bones, and the tumor itself cast no shadow.

Symptoms referable to the various systems.—These were negative with regard to the respiratory, cardio-vascular, genito-urinary, and nervous systems. He believed his gastro-intestinal system was at fault, as his appetite was only fair, he had indigestion and was constipated, all of which caused weakness and lassitude.

Family history.—Wife died of pneumonia two years ago. He is the father of nine children, all living and well.

Previous History.—Typhoid fever in 1906. Hemorrhoids removed in 1908.

Physical Examination.—Head, neck, throat and abdomen were negative. Blood, Wassermann reaction was negative. No leucocyte count was made. It is likely that a white cell count would have shown a leucopenia.

A hard, symmetrically round, cartilaginous mass is felt in the ischio-rectal fossa. It is tender, and the skin is movable over it. It does not feel or appear inflammatory. Digitally it is hen egg in size, and very dense—its most striking feature—and apparently attached to the inner side of the ischium. No hemorrhoids, nor any lesion of mucous membrane can be detected.

Diagnosis (tentative).—A growing tumor, probably lipoma with a tough capsule. Actinomycosis and gumma were considered.

Operative Note.—Under novocain anesthesia a crecentic incision was made between the anus and the tuberosity of the ischium, in order to place the scar where there would be the least wear on it, keeping in mind his occupation of railroad engineer. The tumor was densely adherent, and was removed *en bloc*. The wound was closed by suture. A small rubber tissue drain was placed in one angle, and removed on the third day, on which day he had his first bowel movement. After operation the tumor was sectioned and the capsule found to be two millimeters thick. Its interior contained thin pus. Tubercle was then for the first time suspected. On the third day the pathological report was returned, and our post-operative diagnosis confirmed. Stitches were removed on the seventh day, when a small

\*Read before the American Proctologic Society, June, 1921.



amount of pus escaped. The after-treatment was based on Carrell's technic. Smears were made on the fifteenth and twenty-fourth day, and reported positive for tubercle bacilli, and again on the thirty-fifth day, when the report was negative. The wound was healed on the fortieth day.

The patient developed five boils on various parts of his body during convalescence. During his stay in the hospital, the temperature at no time was above normal. This man has worked continually since, and recently reported that he was in good health.

When the examination of the smears showed tubercle bacilli, it was evident the organism had reached beyond the very dense capsule, or that the latter had been opened in the operative manipulation. Post-operative recovery might have been hastened by applications of Finsen light or of  $x$ -rays. Gibson of Denver has reported cures of pulmonary tuberculosis by use of massive doses of  $x$ -rays and since the local lesion might have furnished a focus for systemic infection, such measures should have been used.

It would be of great interest to know precisely how the infecting organisms gained admission to the fatty tissue in the fossa. Since an ordinary abscess usually results from inoculation of pyogenic bacteria through an abrasion or on injury to rectal mucosa or anal membrane, and since it is agreed that tubercle bacilli may be ingested with food and pass through the intestinal tract undestroyed by the digestive juices, it is likely the tubercle in our patient had its origin from infected food, plus a local lesion.

Primary tuberculosis in the ano-rectal region is well known, but most references in the literature are to the ulcerative lesions of the mucous membrane, or to fistula. Also described are miliary deposits, which are prone to break down producing tuberculous ulcers.

Hanes in his Detroit paper called special attention to frequency of tuberculosis in the peri-anal fat spaces of poorly nourished subjects, when there is no other evidence of the disease in the body. Gant, on the other hand, has written that ano-rectal abscess and fistula are infrequent complications of bowel tuberculosis. I believe the case in point furnishes evidence that primary tuberculosis of the ano-rectal region does exist.

#### CONCLUSIONS.

Primary tubercle of the ischio-rectal fossae may exist without any other evidence of the disease in the body. Where the disease is distinctly localized, complete excision together with extensive application of actino-radio-therapy would seem to furnish the best hope of complete eradication of the disease.

After operation frequent observations should be made of the patient who must be regarded as a tuberculosis suspect.

#### A CLASSIFICATION OF RECTAL FISTULAE: TREATMENT OF EACH VARIETY.\*

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Many rectal diseases would receive better treatment if more attention was given to the embryology, anatomy, physiology and hygiene of the rectum, anus, and contiguous structures. Especially is this true with reference to fistulae.

The primitive intestine consists of a groove, but soon becomes a straight tube of mesoderm lined by entoderm. This tube—ending blindly in front and behind—consists of the foregut in the headfold, the midgut in the body proper, and the hindgut situated in the tailfold. In our study we are more especially interested in the last (the hindgut).

When the proctodeum invaginating from the exterior opens into the hindgut, the continuity of the alimentary canal is established (as is the case at the oral end through the stomatodeum). During this fusion the anal sinuses, crypts and columns of Morgagni are formed and the site of the junction is mapped out for the remainder of the individual's life by the pectinate line. For years, I have emphasized the importance of this pectinate line as a guide to rectal diseases—the great majority of these affections starting to develop either at the line itself or nearby. Quite recently I have enlarged this conception to take in the rectal fascia, and have christened the arrangement the "splanchno-somatic funnel". The fascia without, and its appendage, the pectinate line, within, the bowel mark the division between visceral and perineal diseases; that between tuberculosis of the rectum, let us say, and fissure-in-ano, between rectal fistula and anal fistula, etc.

The sinuses, crypts and diverticula at the pectinate line form admirable catch-basins for foreign bodies and bacteria, and this unfortunate fitness is shown by the fact that about 85 to 90 per cent. of fistulae open in this region, in other words as ano-rectal fistulae. An anal fistula is below this line, a rectal fistula above it. (Right here I must emphasize that in this paper I am referring to complete fistulae, as they are called, with two openings; not to the in-

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complete variety with but one opening, and which is in reality a sinus).

When bacteria are penned up in the diverticula and crypts, they manufacture toxins which aid in producing irritation, and this in turn is followed by congestion, inflammation and their escape into the adjacent structures. When sufficient in amount to give rise to abscesses the pus borrows in the direction of least resistance until it finally escapes through the skin or mucosa, forming an external or internal rectal sinus, or escapes through both skin and mucosa, forming a fistula.

As the inner opening of the fistula is the important one, it follows that the best classification is founded on the anatomical location of this aperture. Therefore, we recognize fistulae as *anal* (the opening being located in the anus); *ano-rectal*, with the opening at the pectinate line; *rectal*, (when through the wall of the rectum proper); and *recto-sigmoidal*, (when through the wall of the bowel at the recto-sigmoid). Watering-pot, multiple, horseshoe, and other so-called varieties are merely expressions of complexity, multiplicity, position or shape of one or the other of the foregoing divisions, or combinations of them.

Each type of fistula calls for a different plan of relief, since it would be unwise to apply the same treatment to a simple anal channel (perineal fistula, for instance), as is resorted to for one high up.

Beginning then with the *anal*—or simplest form—all that is needed is incision. This is a purely local perineal condition, and should heal promptly. It is this variety of fistula that the surgeon has in mind—and it is the type he operates upon—when he tells you that he cut the sphincter in two, three or more places at the same sitting and has no fear of incontinence.

When we deal with an *ano-rectal* fistula, however, the state of affairs is more complicated. Then the complete dissection of the fistulous track and immediate suture, the procedure I have long advocated and practiced, will give the best results.

When we get higher up in the bowel and are confronted with a true *rectal* fistula,—the inner orifice being in the ampulla, two or three inches from the anus—excision with immediate suture is impracticable and my "seton-method" is called for. In *recto-sigmoidal* fistula, the condition is still more grave. Here my method of applying the ligature has given splendid results.

The gravity of the condition—other things being equal—is governed by the position of the internal

opening. With that closed, the course of stercoral infection is shut off, the fistula becomes an external sinus and amenable to treatment by proper measures. A rectal fistula with a single tract, and one opening into the rectum, is much more serious than an anal fistula with two or more openings into the anus, and twenty-five, forty, or more openings on the buttocks. The number of external openings has but little to do with the relative gravity of the case. In this connection I have collected 6,296 case-reports in which the location of the external aperture is noted, and find the well-known tendency to avoid the mid-line thoroughly established. But 1,262 were in the median line, and only 154 of these behind the anus. Some 5,437 were on the sides, with a slight excess (129 cases) for the left. The balance (227 instances) were of the horseshoe type.

In closing, I wish to notice the abortive treatment, although, sorry to say, we seldom have opportunity for putting this into effect. The time to abort a fistula is during the abscess (or infective) stage. If the focus is evacuated early, and the abscess wall not tampered with by instruments or drugs, but the cavity freely drained and gently filled with bismuth paste, every two, three or four days, the fistula stage will generally be prevented. As a rule, however, when patients consult us, the fistula has been present for weeks, months or years (46 years, for example; as in Mackenzie's case).

31 N. STATE ST.

## PRESERVATION OF THE ANAL MUSCLES IN OPERATIONS FOR RECTAL FISTULAE.\*

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There is no surgical procedure more universally accepted and practiced than division of the sphincter muscles when operating for rectal fistulae. Almost all surgeons agree that the muscles should be divided when there is an "internal opening", and many teach that when an opening cannot be found one should be made through the anal wall and the muscles divided. There are a few who advise suturing and covering over the internal opening with mucous membrane. The latter method may be employed with success occasionally, but where there is a great deal of disease involving the anal tissues it can not be relied upon.

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Patients also understand that it is necessary to injure the anal muscles when operating for fistula, and for that reason may refuse operation for fear they may not be able to control the bowels. When they do submit to operation, and experience more or less loss of control, it is accepted as a rule that it could not be avoided and in their situation as little is said about it as possible. I feel confident that those who operate for rectal fistula, and who believe it is necessary to divide the anal muscles would be less inclined to resort to this procedure if they fully realized the embarrassing and distressing experiences to which these patients are subjected.

One reason for so little importance being attached to dividing the anal muscles is that some patients who have their muscles divided, or completely destroyed, have very little difficulty in controlling their bowels. I have three patients under observation now who have practically no anal muscles. In two of these the muscles were destroyed by an operation for pruritus ani, and in the third the muscles were divided three times for fistula. None of these patients has any trouble with his bowels except under purgatives, or when the bowel content, for any reason, becomes liquid. Of course, as soon as this condition develops there is no control whatsoever, and the patient is confined to limited activities until the bowel returns to its former state.

I have heard the statement made that injury to the sphincter muscles when operating for rectal fistulae was of little consequence and that patients subsequently had no difficulty in controlling their bowels. Yet a friend of mine who was most reckless in dealing with the anal tissues when operating was twice brought before a court of justice for injury to these tissues. Patients who have had the anal muscles so mutilated are able to control their bowels because they are habitually constipated. When the bowel content, as it passes down into the rectum occupying the hollow of the deep sacral curve, it well formed it requires no little force from above to move the solid mass forward and almost in a horizontal line toward the anal outlet.

If there is a tendency for the bowel content to remain soft or liquid there can not be complete control unless the mechanism for this purpose is in perfect repair. The motions of the body in going about and the contractions and relaxations of the abdominal walls will force the thin material against the anal structures through which more or less will escape. The higher up the sphincter fibers are divided the less able will the patient be to control the bowel.

When the levator ani muscle is hypertrophied and remains abnormally contracted, which is often the case, complete destruction of the sphincter fibers below may fail to produce the slightest degree of incontinence, but when the muscle has a tendency to relaxation any injury to the sphincters will impair control.

The simplest and most convincing means of ascertaining the amount of damage that is done to sphincteric control when the muscles are divided is to give a purgative that will produce a liquid stool. It has been my experience that most patients so operated upon state that they prefer to take no chances and therefore remain near some place where expedition has no obstacles.

A physician consulted me a few days ago in regard to an operation he underwent for rectal abscess in 1903. He complained of moisture and painful irritation about the rectum, inability to control gas, and that when he took a purgative he could not attend to his professional calls unless he took paregoric or some other opiate to check peristalsis. He wears a dressing next to the anus almost continuously to avoid possible accidents. There is a constant tendency for the mucous membrane to prolapse into the anal opening which causes local distress and extreme nervousness. He is frequently embarrassed because of the soiled condition of his linen. His muscles were divided in the right anterior quadrant, which is far more injurious to control than division in the posterior quadrant. By removing the prolapsing mucosa and by cauterizing very lightly the diseased and granular tissue in the rectal outlet he will be greatly improved.

A few months ago I operated upon a surgeon for rectal abscess. He was operated upon for a similar condition several years ago and the muscles were divided in the left anterior quadrant. For the past few years he had worn a pad continuously and suffered a great deal of annoyance in keeping himself free from moisture, offensive odors, etc. When I operated there was a large opening through the anal wall in the right anterior quadrant. The anal muscles were not disturbed. The mucous membrane which sagged into the anal canal was removed with clamp and cautery and the anal surface, especially in the area of the internal opening, was carefully cauterized. The abscess cavity and the opening through the anal wall were also thermo-cauterized and all parts healed without difficulty. The patient now has much less annoyance, seldom wears any kind of protection, and has a great deal better control. If the



muscles had been divided on the right side, as they were on the left side in the previous operation the patient would, without question, have lost control of his bowel completely.

It will be observed that division of the muscles in the anterior quadrants is a great deal more harmful to control than in the posterior quadrants and should be avoided if possible. This is due to the fact that there is less muscular tissue in the anterior anal walls and their attachments are less favorable to sphincteric contractions.

As shown in the two clinical cases above mentioned patients who have had the sphincter muscles divided and have annoying symptoms as a consequence thereof, will experience slowly increasing severity of these symptoms. Especially will the moisture, odor, chafing and prolapse of mucous membrane become more pronounced with the lapse of time.

I feel sure that few properly appreciate, however careful they may have been, the annoying experiences that come to patients who have been operated upon for rectal fistulae. There are many patients who would gladly submit to operations for rectal fistulae if they could be assured that none of the complications herein detailed would fall to their lot.

It is practically correct to say that all rectal fistulae are chronic or are old abscesses which are produced by infection passing through the anal or rectal walls into the fatty tissues surrounding these parts. The muco-cutaneous surface of the anal canal, including the mucosa of the rectum, which is held in long longitudinal folds by contraction of the sphincter muscles, is very frequently found to be in a state of chronic disease; and it is from the bacterial life resident in these tissues that infection so frequently invades the adjacent and less vital structures. This results in abscess formation.

When the infection of the anal tissues has extended over long periods the muscles usually become very much hypertrophied and irritable. When they are dilated it will be seen that the folds of tissue within their grasp are in an unhealthy state. It is not infrequent that these tissues are so devitalized that they easily break down when put on tension. Especially is this true of the tissues in the posterior anal structures. I have often placed the tip of my index finger on these structures when the muscles were well dilated, and by very moderate pressure the muco-cutaneous lining would separate and leave the anal muscles on the posterior surface clearly exposed.

Anal fissures are nothing more than breaks in these diseased and necrotic tissues where internal

fistulous openings may be found. Fissures are observed more often in the posterior anal surfaces, for the reason that the anal structures are most frequently and extensively diseased here. The same explanation accounts for the internal opening of rectal fistulae occurring much more frequently here than elsewhere in the anal wall.

Internal openings of rectal fistulae are always found in the anal walls, and not through the rectal walls as is often supposed. Of course, the exceptional cases in which the opening is found in the rectal wall, belong to that class of patients with disease in the rectal mucosa, as in trauma, ulcers, strictures, etc. It should be kept in mind that the internal opening in any case represents a necrotic or granular area in the mucosa or the muco-cutaneous structures, at which point the membrane is least resistant and breaks down. Pus from an abscess adjacent to the rectum would never break through the mucosa at any point, through either the anal or the rectal wall, if it were not weakened from disease. It not infrequently happens that a large rectal abscess breaks externally, or the pus burrows extensively, when there is at the same time a diseased state of the anal tissues from which the abscess originated. In such cases there are intervening structures which do not allow the pus to pass back through the anal wall, but when operating for the abscess, or subsequently for fistula the opening into the bowel may be easily discovered.

I believe the most forcible argument that could be produced in settling this question is that of having a surgeon select another surgeon to operate upon himself for rectal fistula. Would he select the surgeon mentioned above, who had been in the courts for the reckless manner in which he had dealt with his patients, or would his choice be the surgeon who had the greatest respect for the mechanism which nature had provided for perfect bowel control?

There are three chief features to be observed when operating for rectal fistulae. The first consists in removing hemorrhoids, hypertrophied anal papillae, etc., in the rectal outlet. Or if there is any ulceration or necrotic condition of the anal membranes, this should be treated by thermo-cauterization, especially at the point of the internal fistulous opening. When the diseased tissue in the outlet from which the original infection had its origin has been properly cared for, the second step consists in dealing with the fistula proper, which is exterior to the rectal and anal walls. Whatever complication may exist, as much as possible of the dense fibrous tissue



which is often present should be removed by dissection or by cauterization or by both. Hard fibrous tissue allowed to remain after these operations is the greatest impediment to successful healing. All the fibrous or diseased tissue must be dissected away from the ano-rectal wall at the point of the external opening. The tissues surrounding the external opening should be so divided that this part of the wound affords complete drainage. It will be seen now that the opening through the anal wall is not more than one-third or one-fourth of an inch in length. It may be lightly cauterized with pure phenol or a very small Paquelin point. Care should be taken to avoid increasing the size of the opening by the introduction of various instruments.

By following out this method of operating, the contour of the external anal opening is never destroyed. Whatever the extent of the wound on the outside, the anal muscles have not been divided and there can be no wide separation of the divided ends which must remain apart as the wound heals. There could never again exist complete contraction of these fibers which is necessary to control a liquid state of the rectal content.

During the after-treatment of the main fistulous wound the anal muscles must be kept dilated every two or three days with the finger or some instrument made for that purpose, to avoid unhealthy granulations and deposit of fibrous tissue leading to contraction.

If the opening through the anal wall is large it may be stimulated occasionally with some chemical agent. When the wound on the outside is about completely healed novocain may be introduced into the tissues and the muscles divided if the opening through the wall refuses to heal. Under these conditions there will be but little gaping of the wound and the divided muscle ends will be only slightly separated. The opening through the anal wall will usually be healed before the fistulous wound has completed this process.

Of course, in operating upon various complicated conditions often associated with rectal fistulae, it may be necessary to divide the anal muscles, but I wish to emphasize that the practice of wholesale division of the anal muscles for fistulous conditions is unnecessary.

I feel fully convinced that most fistulae, free from extensive complications, can be successfully operated upon with no appreciable impairment to anal control by observing the foregoing precautions.

## BIOPSY OF INTESTINAL TUMORS AND A NEW SPECIMEN FORCEPS.\*

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Some years ago, as the result of the considerable discussion at that time of the question of probatory incision of tumors, a special committee of the Society for the Control of Cancer, prepared a report on the subject for the Department of Health of the City of New York, which was published in its Weekly Bulletin of March 12, 1915.

The two paramount and practical questions presented were—

- (a) The advantage of a positive diagnosis.
- (b) The danger of aggravating by trauma.

This special committee concluded that:

"It is universally agreed by surgeons and pathologists that in a large group of cases the former advantage decidedly outweighs the danger of the latter.

"It is therefore the universal practice to support the clinical by a microscopic diagnosis in cases of reasonable doubt.

"Since gross diagnosis of malignancy in tumors is difficult and sometimes impossible, it seems proper to facilitate as far as possible the means of securing accurate microscopic diagnosis.

"In general, the biopsy becomes desirable when the clinician is in doubt and a decision is urgent. Against these considerations stands the danger of aggravating the disease by trauma. The extent of this danger will depend on the nature and position of the tumor and must be judged in each case.

"Not a few errors in diagnosis result from incision of inflamed tissue on the edge of the tumor, the malignant area being missed. This is particularly apt to occur with inaccessible growths.

"In general, incisions into actively growing, deep-seated, malignant tumors should, if possible, be avoided. Such a trauma may disseminate tumor cells through the vessels or permit unnecessary extension to the skin or surrounding tissues, or accelerate growth by relief of capsular tension.

"On the other hand, there is little danger from excision by the clean cut of a sharp knife of a suitable portion of any suitable growth of skin or mucous membrane. Under all circumstances, it is highly important to avoid rough handling, kneading or crushing of tissue.

"The wisdom of biopsy may often depend on the possibility of obtaining a reliable opinion from the microscopist, in the absence of which it is better to rely on clinical judgment."

No one will gainsay the desirability of a pre-operative biopsy to confirm the clinical diagnosis.

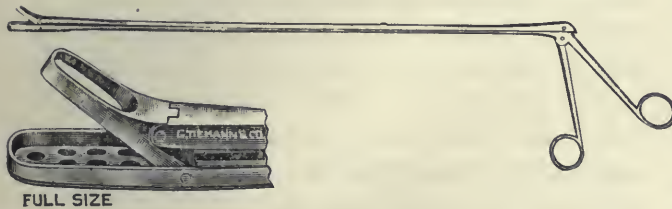
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This has the very practical advantage of enabling the surgeon to plan the operation in accord with the findings. Contrast, if you will, the limited mutilation in the removal of a benign polyp of the rectum with wide excision for carcinoma.

The dangers of diagnostic incision have been justly emphasized by some authors, but in general, the writer concurs in the conclusion of the committee that there is "little danger from excision by the clean cut of a sharp knife," but that "rough handling, kneading, or crushing of tissues" is to be scrupulously avoided.

Wood<sup>1</sup> states: "It is usually assumed that the recurrences of the tumor along the scar, so frequent after amputation of the breast, are due to opening lymph channels; but experimental evidence makes it seem much more probable that both the handling of the tumor before operation, when it may be palpated by a dozen physicians for diagnostic purposes, and the manipulation of the organ during excision are much more likely to be the cause of



the distribution of the tumor particles. The frequency with which hemorrhagic areas are found in tumors removed by operation and that with which freshly dislodged cancer particles can be demonstrated in the blood and lymph vessels suggests this explanation."

Wood and his colleagues carried out experiments on 673 white rats bearing the Flexner-Jobling adeno-carcinoma which frequently metastasizes (and similar experiments on the Crocker Fund rat sarcoma No. 10, using 384 animals). These experiments showed that "metastasis is not increased when the tumor is incised, a fragment removed aseptically, and the tumor allowed to remain in the animal for from 10 to 12 days thereafter. It permits the deduction also, that human tumors are probably not widely distributed by incision, as has been thought, and that, therefore, when these tumors are situated in such portions of the body that a mutilating or highly dangerous operation is necessary for their removal, they should be examined microscopically, *if a diagnosis can be made in no other way.*"

Ewing<sup>2</sup> says: "The character of polypoid or ulcerating tumors of the rectum may be safely deter-

mined from portions of tissue removed through a speculum, but incisions into hard cancerous strictures should be avoided."

Certain lesions of the rectum within the palpable area can be diagnosed clinically with a considerable degree of accuracy. For example, an ulcerating carcinoma imparts a characteristic feel to the examining finger of the experienced clinician. However, in the earlier stages, the examiner may be less positive and he must differentiate other conditions as indurated ulcers, strictures, tuberculoma and benign growths. Direct inspection of these lesions through the proctoscope may clear up the diagnosis, but not always. Again, these lesions may be, and often are, located at a point beyond reach of the finger. In such cases the valuable data of direct palpation are not obtainable.

To surmount this difficulty the writer devised about four years ago the biopsy forceps here illustrated, and has employed it since in cases that could not be diagnosed by other methods. The forceps has now been used in a large number of cases with most gratifying results, and no unfavorable consequences.

The technic is very simple. The patient assumes the knee-chest posture as for sigmoidoscopy and the sigmoidoscope is introduced. The forceps is then passed through the tube and under direct vision, a section is "bitten out" at a point in the pathologic process most likely to yield the greatest amount of information under the microscope. In cases having an ulcerated lesion (chronic indurated ulcer, stricture, cancer or other tumor) this would be at the margin of the ulcer. In non-ulcerated tumors a specimen is taken from the neoplasm itself. Hemorrhage is slight and quickly controlled by the immediate topical application of pure phenol or lunar caustic stick.

In a few instances, after operation, the question has arisen of diagnosing malignant recurrence from stenosing scar tissue at the line of the intestinal suture. Biopsy determined this point promptly and decisively.

In another class of pathologic changes, felt as tumors per rectum, biopsy is contraindicated. This applies particularly to enlargements of the lymphatic glands of the mesorectum, especially to tuberculous adenitis in children, and to metastatic involvement of these glands by carcinoma in adults. Further, infiltration of the recto-vesical pouch or cul-de-sac of Douglas by metastases from malignant growths or tuberculous peritonitis, opposes biopsy. In this



category of cases the mucosa of the rectum is usually felt to move over the surface of the tumor and not to be involved in the process. In these cases, local findings together with the other clinical data usually suffice for a correct diagnosis. Biopsy through uninvolved mucous membrane could lead only to an extension of a disease not suitable for or amenable to radical operation and yield no compensatory benefit to the patient.

The forceps is strong and rigid, 13 inches long, giving a working length of 2 inches distal to the end of the 10 inch sigmoidoscope of my model. The jaws have a cutting edge so that the tissue is cut out and not crushed. The specimen retained intact on the grilled floor of the lower jaw is  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in length, which is ample for microscopic examination.

The forceps is also useful for the radical removal of small benign polyps so often present on the mucosa of the terminal colon.

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### HYPERTROPHY OF THE ANAL PAPILLAE.\*

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Many ailments generally looked upon as minor, assume a role of major importance in the mind of the patient. Especially is this true of diseased conditions affecting the anal canal, on account of the very abundant and intricate nerve supply of the ano-rectal muscular apparatus.

Hypertrophy of the anal papillae is one of the conditions falling within the above category, and one which has received scant attention by the medical profession until quite recently, and now practically only by those specializing in rectal surgery. It is a condition which, so far as my experience goes, is unknown to the general practitioner. I make this statement for the reason that never, in my hospital or office practice, has a case come to me with the diagnosis made or even suggested.

For these reasons, I venture to discuss this topic, commonplace as it is, in the hope thereby to reach, and arouse some degree of interest in, the men who, as a rule, are the first to see and give advice concern-

ing rectal diseases, viz., general practitioners of medicine.

Hypertrophy of the anal papillae is a definite surgical entity of much importance on account of many attendant disagreeable symptoms and numerous resultant reflexes, although it never endangers life and rarely prevents one continuing his usual vocation.

The anal papillae are located upon the borders of the semilunar valves forming a dentate margin at the ano-rectal junction. Opinions differ as to whether or not they are special rectal tactile organs. They vary in number up to eight or ten and are frequently absent.

When hypertrophied they are readily seen through the anoscope, or with the anus thoroughly everted, and they may be felt on digital examination. They vary in length from a quarter of an inch to an inch or more, and occasionally one of these very long papillae has been mistaken for a rectal polypus.

In making a diagnosis it is to be borne in mind that the papillae are of uniform width throughout, while a polyp is always pedunculated.

The symptoms accompanying hypertrophy of the anal papillae are many and vague. Those which I have observed are a crawling or tickling sensation or uneasiness in the rectum, disagreeable pressure, pain, usually not severe, sometimes relieved by a movement and sometimes worse for a time after defecation, a feeling that defecation is incomplete or unsatisfactory, spasmodic contraction and hypertrophy of the sphincter muscle, constipation, pruritus ani, anal fissure, neuralgia of the rectum and sciatica.

In my cases the most constant symptoms have been the feeling that the act of defecation is incomplete, and the uneasiness and disagreeable pressure which accompanies sphincteric contraction. This latter feeling lasts for a variable length of time and is probably due to the fact that the enlarged papillae are crowded down into the grasp of the sphincter, relief coming only after a more or less prolonged period of retraction.

When one of these papillae becomes quite long, the time required for retraction, as well as the accompanying discomfort, are naturally prolonged.

Not only this, but its presence acts as an irritant to the sphincter muscle, causing a spasmodic contraction.

Daily repetition of this condition, with the recurring contraction, causes the sphincter muscle to hypertrophy, and there arises the condition commonly spoken of as tight sphincter.

Anal fissure may result from the tearing down of

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one of these enlarged papillae. Neuralgia of the rectum is a quite common symptom and sciatica a frequent one.

A patient who came to my office recently and in whom I found no other lesion, excepting a slight cryptitis, complained of pain in the right sciatic nerve more than of anything else, and every time I made pressure with the end of my finger on one of the enlarged papillae she remarked: "there is a sore spot and that pressure gives me the same pain down the right thigh which I frequently experience." This point is of interest, as it shows the immediate reflex effect of irritation in the anal canal upon the sciatic nerve.

I shall quote from the histories of three cases, which I have treated during the past year, as illustrating the patient's story of the subjective symptoms accompanying the condition:

"For three or four months have had an uncomfortable feeling in the rectum, no severe pain but disagreeable pressure which is worse after defecation."

Another patient says: "Have had pain in rectum for two years, generally relieved by a movement. When feces get down in the rectum am very uncomfortable until bowels move."

A third one says: "Have had a disagreeable pain in the rectum for two months, which is perhaps more a soreness than pain, accompanied by severe pressure. It is worse just before and after defecation and seems to cause sciatica in right leg. After bowels move feel as though I was not through. Am growing very nervous."

Treatment consists in removing the papillae, preferably with scissors. As a rule, no vessels require ligation. When the sphincter muscle is hypertrophied a general anesthetic is employed, otherwise the operation may be satisfactorily done under local anesthesia. Confinement in bed is not necessary. When cryptitis is present it is sometimes necessary to treat the inflamed crypts with 10% cargentos solution a few times during convalescence.

Consideration of this subject emphasizes the necessity of making a thorough examination in all cases where patients complain of any, or many, of the vague symptoms I have enumerated.

Perhaps in no class of cases has so much guesswork been employed as in dealing with rectal diseases. In all branches of surgery, as well as in general medicine, or any of the specialties, the conclusion is always the same, a thorough examination followed by a correct diagnosis is essential to intelligent treatment. To these every patient is entitled.

## BLEEDING FROM THE RECTUM; ITS SIGNIFICANCE AND TREATMENT.\*

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Bleeding from the rectum is one of the most frequent and alarming symptoms of rectal disease and, next to pain, is the most frequent cause for consulting a physician.

Blood passing through the anus may come from the rectum, sigmoid, colon, small intestines, duodenum or even the stomach. It may be slight or profuse, occasional or frequent, it may occur during, in the intervals of, or after defecation. It may be discharged as pure blood, fluid blood or clotted blood, or it may be mixed with mucus, pus or feces.

The nearer the location of the cause of the bleeding to the anal outlet, the lighter is the color and the fresher is the appearance of the blood; and inversely, the further away from the anal opening, the darker the color, and the thicker and more clotted its consistency.

The bleeding may come from only one blood-vessel or from numerous bleeding points or ulcerations, and may be arterial or venous.

The general appearance of the patient is often an index to the importance and severity of the bleeding. Profound anemia following bleeding from the rectum is of frequent occurrence, and very often immediate transfusion, followed by prompt attention to the lesion causing the bleeding, is the only thing that will save the life of the patient.

Internal hemorrhoids very often bleed owing to severe straining at stool followed by rough handling with paper, or when a hard fecal mass is propelled through the rectum and anus, denuding the surface of the greatly enlarged hemorrhoids, engorged with blood to the bursting point. There may be only the expression of a few drops of blood, but sometimes the bleeding is so severe as to cause complete exsanguination. Frequently on anoscopic examination, one can see the blood spurt from an ulcerated hemorrhoid. Bleeding from hemorrhoids is usually venous. It may be slight and noticed only on the paper, or it may ooze from the anus for a short time after defecation, or it may be so profuse as to cause the patient to faint from loss of blood while at stool, and become so exsanguinated that

\*Read before the American Proctologic Society, June, 1921.



death may ensue before bleeding ceases or can be arrested. When the bleeding is profuse and occurs at frequent intervals, the patient may become profoundly anemic, lose weight, become incapacitated, simulate cachexia, assume a pale yellow and waxy appearance, become nervous and melancholy; and only after operation with or without transfusion, when the patient notices an increase in weight and improvement in color, can he be convinced that he is not suffering from a malignant growth or other incurable disease.

The ancient belief that bleeding from the rectum is good for the patient and that if arrested will produce some internal disease or death is "taboo".

Thrombotic hemorrhoids frequently rupture of their own accord; and when part of the clot remains protruding, the wound is kept open and is accompanied by a constant oozing of blood until remedied by completely turning out of the clot and trimming the edges of the wound.

Fissures or ulcers of the rectum cause arterial or venous bleeding, the severity of which depends upon the extent of the lesion and the size of the vessels involved. Patients with fissure give a history of straining at stool, passing a very hard fecal mass, followed by a burning pain and some blood. Some pass only a drop of blood, others a streak of blood on the fecal mass, and others will report that the blood trickled down their legs even after defecation; still others, that the bleeding was so profuse that they fainted from loss of blood. The deeper the ulceration the more severe the bleeding, and the loss of blood may be so large that it may lead to complete exsanguination. This type of bleeding is often most severe in tuberculous, syphilitic and malignant ulceration.

When a prolapse of the rectum is very large and when it protrudes and rubs up against the clothing of the patient; or when an attempt is made to reduce it, bleeding will often follow.

Severe bleeding is often found in malignant disease, due to the destruction of tissue becoming so deep that it invades the large bloodvessels, often resulting in death from exsanguination.

Polypi bleed at every stool, and this bleeding is caused by the denudation of the surface by the fecal mass. They are most frequently found in children. Hemorrhoids are extremely rare in children, but when a mother says that her child has hemorrhoids, or that a hemorrhoid protrudes at stool accompanied with blood and then returns spontaneously or must be returned with the finger, one may be sure that the child is suffering with a single polyp. They are usually low down and can be reached by the

finger, or when pedunculated, may be high up and can be located by proctoscopic examination.

Multiple polyposis or adenomata are numerous, soft, do not protrude, but give rise to colicky peristalsis, due to an effort on the part of nature to expel them. These evacuatory movements are attended with much blood and very often with a prolapse of the rectum, which, on account of the size of the mass due to the number of polypi, frequently require the services of a physician to reduce. It is important that this condition should be promptly recognized for, if neglected, it usually degenerates, within two or three years, into adeno-carcinoma, in about 50 per cent of the cases. Constipation is an early symptom followed by diarrhea, with blood mucus and tenesmus, loss of weight, anemia, etc.

In intussusception of the sigmoid, repeated traumatism of the parts, from repeated straining during frequent attempts at defecation, results in inflammation, ulceration and blood with every stool.

Chancres, chancroids, and condylomata bleed very freely when friction is applied by the use of paper after defecation. Condylomata bleed easily, due to friction produced by a fecal movement, by walking, or by rubbing against the patient's clothing, usually when fragments are broken off. Villous growths bleed freely during defecation, but these are very rarely encountered.

Systemic diseases such as malaria, scurvy, tuberculosis, typhoid, etc., may give rise to bloody stools in the course of the disease. In typhoid, the passage of mucus streaked with blood is often a warning signal of impending perforation and hemorrhage.

Hemorrhagic proctitis occurs usually in young adults, and is the cause for profuse bleeding from the rectum with every stool. The blood is bright red and usually of sufficient quantity to produce a severe anemia in the patient. This condition is frequently diagnosed as "piles" and the patients are often subjected to two or three operations, presumably for hemorrhoids, until, still seeking relief, they come across a physician who takes the time and trouble to make a proctoscopic examination, when a dark-red, spongy, ulcerated mucous membrane is noted, blood oozing from numerous ulcerated areas, with patches of mucus. The patients have from 10 to 50 stools a day, and usually expel only a small quantity of blood and mucus. In these cases, only the lower four or five inches are involved, and the condition is not accompanied with any rise of temperature, as in hemorrhagic colitis, which is generally caused by a pneumococcal infection. These cases are best treated by swabbing the hemorrhagic areas with fuming nitric acid to produce



fibrosis followed by a superficial scar, which toughens the mucous membrane, and which prevents any further abrasion that may cause bleeding. Rectal irrigations of silver nitrate, never stronger than 1-10 per cent, or irrigations of krameria or of the colorless hydrastis solutions, and calcium lactate or chlorid internally, may be of service.

Sarcoma of the rectum or colon is very rare, and when it does occur, hemorrhage is not a prominent symptom. I encountered only one case in my practice, about two years ago, of a large spindle-celled sarcoma of the rectum, which I reported in the *New York Medical Journal*, November 15, 1919.

Carcinoma is very common and, according to statisticians, about three and one third per cent. of all cancers are in the rectum. The early symptom of cancer is the passage, from the rectum, of blood or blood mixed with mucus. This symptom should call for a prompt and thorough proctoscopic and colonoscopic examination for the detection of cancer in its incipency.

Operations about the anus and rectum are always accompanied by a certain amount of bleeding, the amount of bleeding depending upon the length and depth of the incision. Incisions produced at right angles to the bowel cause more bleeding than those made parallel to the long axis. When the bowel is cut at right angles, some of the hemorrhoidal veins and their branches are severed; but when cut parallel to the long axis of the bowel, the incisions are made parallel to and between the vessels, and without injury to them. This accounts for the severe bleeding produced in the cuff operation for prolapse, and in the Whitehead operation, which is now but very rarely used and is becoming obsolete.

Primary hemorrhage usually occurs during an operation when a vein or an artery is severed and is very profuse, but capillary oozing is easily controlled by pressure. Bleeding may be caused by overlooking a bleeding point during an operation, or because the doctor thinks that he can control the bleeding by pressure. Some patients bleed easily, due to the diminished coagulability of the blood, or due to some vaso-motor disturbance.

Recurrent hemorrhage is more serious, and generally takes place when a vessel has been injured during an operation and is overlooked, or when a ligature slips or has been improperly or insecurely tied. This takes place within a few hours after operation.

Secondary hemorrhage takes place a few days after operation, (usually five to eight days), where a ligature has cut through a bloodvessel, or it may follow sloughing or ulceration due to burning or pressure

necrosis. This occurs in anemic, debilitated patients, in those who have coughing, or sneezing, or other conditions causing severe straining or tenesmus; or where the bandage which is supposed to produce pressure is lost when transferring the patient from the operating table to the carriage or from the carriage to his bed; or where the patient, in coming out of his anesthesia, unconsciously plucks away the dressing and releases the pressure of the bandage. The bleeding in these cases comes on suddenly, is very profuse, and, unless immediately stopped, may prove fatal. Secondary hemorrhage may also occur in extensive sloughing produced by injection of carbolic acid or in using strong solutions of quinin and urea hydrochlorid for local anesthesia, or in ulceration due to burning or pressure necrosis. Frequently bleeding may be internal and fatal while nothing may be noticed from the anus. Slight bleeding or oozing may be easily arrested. Profuse hemorrhage is always accompanied by well marked and classic symptoms. The external evidence of bleeding is a sudden gush of blood from the rectum, which saturates the dressings and even the bed, and on removal of the dressings a stream of blood will be noticed from the anus. When the hemorrhage is internal, large quantities of blood accumulate in the rectum, become clotted and cause a desire to go to stool, and there is an evacuation of liquid or clotted blood or both; and when retained for any length of time it has a coffee-ground color and a foul odor. This may be accompanied with colicky pains and tympanites along the entire course of the colon, due to the decomposition of blood and gas formation. Frequently internal bleeding manifests itself by an intense desire to urinate, with an inability to void due to distention of the bowel. If this form of hemorrhage is not quickly discovered and arrested, the patient gets a death-like pallor, has an anxious and worried look, calls for much water, gets air-hunger, becomes faint and then unconscious, the pulse becomes rapid, but is soft and thready, gradually becomes imperceptible, the patient collapses and dies of complete exsanguination.

Bleeding from the rectum, however slight, should never be treated by the specialist or the general practitioner without a thorough rectal examination. In this manner many cases of early, and even advanced, cases of cancer of the rectum may be discovered, which otherwise might be passed up as "merely bleeding piles".

When large spurting vessels have been injured or ruptured by disease or direct injury or caustics, or severed during operation, immediate ligation is ad-



visible. The best method of procedure is grasping the bleeding vessel with a clamp, and tying, leaving the ligature long to prevent slipping; or, when a number of bleeding points present themselves, grasping the mass of tissue and ligating it.

Where the bleeding point is due to, or caused by, the slipping of a ligature and cannot be located, the insertion of a proctoscope into the rectum, and then packing from eight to twelve thicknesses of sterile gauze into the rectum through the proctoscope (then removing the proctoscope and allowing the packing to remain) will produce a sufficient amount of pressure, and will stimulate a sufficient amount of contraction of the sphincter muscle to check the bleeding. This method of procedure should be supplemented by pressure from the outside by means of a tight "T" binder.

When the bleeding point is located, torsion and clamping may be tried, or the clamp may be allowed to remain in place until the danger from this hemorrhage has passed. Clamping should be tried where the bleeding vessel is too high up to be securely tied or ligated. Where there is oozing that cannot be controlled by pressure, actual cautery may be tried. Where there has been extreme depletion of blood, so as to endanger the life of the patient, immediate hypodermoclysis or normal saline solution to replace the loss of body fluid, or even transfusion, may be necessary. Strychnine sulphate, grain 1-30 every 4 hours, absolute rest in bed with hips elevated, and a liquid diet, should follow up the transfusion. The patient should be kept warm by means of hot water bottles, and peristalsis should be controlled by frequent doses of morphine sulphate or opium. Strict orders to keep the "T" binder tightly in place to produce pressure is of extreme importance.

Bleeding from the rectum in adults is of such common occurrence that the layman looks upon it as a necessary evil, and in many instances, not until he has suffered a severe hemorrhage will he think it advisable or consent to consult a physician. Many physicians, without making any examination, take for granted the diagnosis of "bleeding piles" given them by the patient and prescribe some salve or suppositories, and feel that they have done their duty. In a recent case of very severe bleeding due to pronounced ulcerated internal hemorrhoids, an excellent gastro-enterologist told the patient that he had no hemorrhoids and prescribed some salve; yet this man had bled to such a degree that his hemoglobin index was 40% and his red blood count was only 2,800,000. Another patient I saw recently was being

treated by a reputable physician, in his office, for a period of seven weeks by means of electricity and other local treatment, and when I saw him, the man was so exsanguinated that his blood showed 35% hemoglobin and only 2,200,000 red blood cells. Both of these cases required blood transfusion before I could undertake to operate upon them.

Many cases of carcinoma are overlooked by neglect of proper and thorough examination. In the past year I have seen three cases of carcinoma of the rectum that had been operated upon for "piles" unnecessarily. The diagnosis in these cases should have been made if the physician had taken the time or the trouble to properly examine the patient. We cannot too strongly emphasize the necessity and importance of a thorough rectal examination in all cases that give a history of blood with their stools. The patients should be examined first with the finger, then, if the passage is clear, with the proctoscope and sigmoidoscope. Primarily the fault lies with the lack of teaching of the proper use of the proctoscope and sigmoidoscope to the students in our medical colleges, and they are being sent out unprepared to take care of the many sufferers of rectal bleeding, unprepared to interpret its importance and significance, and, as a result, unprepared to give the patient the proper care and treatment in these conditions.

345 WEST 88TH STREET.

#### MY PRESENT VIEWS OF QUININ AND UREA IN THE TREATMENT OF INTERNAL HEMORRHOIDS.\*

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Quinin and urea was first used in the treatment of internal hemorrhoids in April, 1913, a little more than eight years ago. A paper, describing the technic employed, with some observations on the effect of the remedy, was read by me before the American Proctologic Society in Detroit in 1916. I feel that no apology is needed for presenting another paper, at this time, along the same lines. With an additional experience of five years, I probably am more competent to discuss the value of the remedy than before. When my former paper was written, the treatment was still in the experimental stage. I now feel that a very satisfactory working basis has been established. In other words, experience has shown what the remedy will do, and its limitations have

\*Read before the American Proctologic Society, June, 1921.



been defined more or less clearly, so that there is little or no doubt of the results to be expected from its use. We now recommend to the patient that his hemorrhoids be treated by injections of quinin and urea, for we know that he will be satisfactorily and completely cured. Another is advised to have a radical operation done, because examination reveals a condition which quinin and urea will not eradicate. In my experience, about fifty per cent. of cases of internal hemorrhoids are amenable to treatment with quinin and urea. In addition, from fifteen to twenty per cent. more may be treated by the same means, if one is willing to attempt the removal of simple complications such as hypertrophied papillae, skin tags, polypi, etc., under local anesthesia, in the office. It is in hemorrhoids with these minor complications that the judgment of the operator is put to a test. In his anxiety to save the patient a radical operation, he is liable to attempt to do more than is safe. If the patient is to be incapacitated or put to bed as the result of the treatment, then it is far better for all concerned that we have a radical operation in the first place, in a well regulated hospital. In considering the removal of some minor complication, its character and location are of prime importance. As every proctologist knows, there are certain areas in the canal which are sensitive and very rebellious to any injury, whereas other parts are almost devoid of sensation. It is an easy matter to get into trouble when working in this region, if not constantly on guard. There is nothing more disconcerting than to have a patient go to bed for a week or longer following the removal of some minor lesion in the anal canal when little or no inconvenience was expected. But all of us have had such experiences.

The percentage of cases treated by me by this ambulatory method is not as large as it was a few years ago, while that of radical operations has grown. I am not certain whether I should attribute this to a better knowledge of rectal diseases in general or whether I have grown more conservative. However, there is nothing more fascinating to me than to watch well developed hemorrhoids disappear under treatment, and to note the relief of symptoms as stated by the patient.

During 1920, not including the work done in the dispensary of the Medical College of Virginia, 285 patients came to me for relief of internal hemorrhoids. On'y those cases in which hemorrhoids caused the predominating symptoms, and seemed to constitute the most important rectal condition found, have been placed in this classification, although many

times during the year other hemorrhoids were removed when operating for fissure, fistula, etc. Of this number, 206, or 72.5 per cent. of the whole, were treated in the office by injections of quinin and urea. Quite a number of these, the exact number I have not tabulated, also had removed by excision, a skin tag, small polypus, or some minor complication.

I performed a radical hemorrhoidectomy, usually under general anesthesia, 79 times during the year. Most of these were considered unsuitable for treatment with quinin and urea, although a few of them might have been handled satisfactorily by this means. Occasionally a patient prefers to have the radical operation. If his physical condition warrants it, he is not persuaded otherwise. I know of no operation in the whole of surgery which gives more uniformly good results, when properly done, than a hemorrhoidectomy, and I do not oppose the operation.

Only simple internal hemorrhoids are suited to this ambulatory form of treatment. I refer to that chronic variety in which the predominating symptom is bleeding, or protrusion, or both. When the hemorrhoids are inflamed, with irritable and tightly contracted muscles, a radical removal is indicated. This condition usually is the result of a submucocutaneous infection which requires incision and drainage, as well as removal of the hemorrhoids, to bring about a complete cure. Hemorrhoids of the mucocutaneous variety, and those internal ones that have become fibrous, as occasionally seen, are best treated by excision. Also, it would be a waste of time to inject hemorrhoids in the presence of a fissure or fistula or any other complication demanding a surgical operation. In such a case I would advise removal of the hemorrhoids when operating for the complication.

In selected cases the results from treatment are uniformly good. If one bears in mind that internal hemorrhoids are primarily varicose veins, containing fluid blood, and that quinin and urea will eradicate these, and only these, then there should be no disappointments from its use. More than this should not be expected of the remedy.

While I have had no experience with other remedies, I am convinced that quinin and urea furnishes the safest and most efficient ambulatory treatment of hemorrhoids yet advised. During the eight years in which I have used the drug many thousands of times, I have had no alarming effects that can in any way be attributed to it. In this time I have found three patients with some idiosyncrasy to quinin. The one with the most pronounced reaction was a man who



stated, before I had completed my treatment, that he felt as if he had taken quinin. He quickly developed a hoarseness and a mild asthmatic attack which lasted some hours. The other two were women. Its use was followed in one by a temporary hoarseness and dry cough, and in the other by a tingling and itching of the skin surface, but no urticaria was manifest. It is well to bear in mind that there are a few individuals who are more or less susceptible to the effects of quinin. Dr. Collier Martin has reported one case in which very alarming symptoms followed the injection of quinin and urea into a hemorrhoid.

I know that most proctologists are well satisfied with the results ordinarily obtained from operating on hemorrhoids and probably do not care to adopt any substitutes as a routine. In my opinion, however, every proctologist should be more or less familiar with some method of treatment other than operative, which may be used when necessity seems to demand it. No doubt each of us has now and then a patient with bleeding hemorrhoids, upon whom an operation is not desirable, for one reason or another. At the same time, it is necessary for his general welfare that all bleeding be stopped. I believe there is no treatment, not even an operation, that will control this more effectively or more promptly than quinin and urea. A single injection of a five per cent. solution into an ulcerated hemorrhoid rarely fails to completely relieve the bleeding at once, although a complete disappearance of the hemorrhoidal tumor will require from four to ten injections, given at intervals of three or four days. There is no objection to treating several hemorrhoids at one sitting, except when the muscles show some spasm or irritability. Then it is advisable to proceed more cautiously, treating only one or two at a time. The injections should be made in the center of the pile, using just enough of the solution to slightly distend it. If properly placed and given slowly, there should be no pain. If the introduction of the needle causes a twinge, it should be withdrawn immediately, for the wrong place has been selected for the injection. Usually the patient does not know when the needle is introduced, for a chronic, non-inflamed, internal hemorrhoid has very little sensation.

For this treatment I prefer to use a medium-sized Brinkerhoff speculum, for the reason that a good longitudinal view of the anal canal is obtained, permitting an accurate placing of the solution where desired. A syringe, small in circumference, is essential. I have found a one cc. Luer syringe, about three and one-half inches long, answers the purpose

nicely. I use on this a number 25 needle. Rarely are the treatments followed by pain, and the patient is allowed to proceed about his business at once. In some cases there is a feeling of fullness and weight in the rectum, beginning twenty or thirty minutes after a treatment, and lasting about the same length of time. Further than this there should be no discomfort as a result of the treatment.

An idea seems to be entertained by some that quinin and urea produces a sloughing of the hemorrhoidal tumors, and that a disappearance of them is brought about through this process. This is not the case. Only a few times have I seen the mucous membrane covering the hemorrhoid turn dark following such treatment, and this was due probably to an overdistention of the pile with the solution. If quinin and urea caused a sloughing with any degree of regularity, I would not sanction its use, for such a process can not be controlled. Furthermore, if this were the effect, severe infections and frequent secondary hemorrhages would preclude its use. Soon after a pile is injected with quinin and urea it becomes somewhat grayish in color, and on digital examination feels hard and fibrous, not unlike an anal polypus. It soon begins to atrophy, and if the treatment is repeated from time to time, it will disappear altogether. The drug evidently causes a diminution of the arterial blood supply to the part, probably from pressure. Atrophy is the result.

#### CONCLUSIONS.

Quinin and urea is a safe and reliable agent in the treatment of simple uncomplicated hemorrhoids. However, only about fifty per cent. of cases ordinarily seen fall in this classification. Radical removal is indicated in the others.

It should not be used as a routine treatment, but only after a careful and thorough examination to determine if the case is suited to the remedy.

The results from its use should be approximately one hundred per cent. cures, but the percentage of cures will depend upon the ability of the operator to select his cases.

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#### DIGITAL RECTAL EXAMINATIONS.

Don't fail to make a digital rectal examination in cases of appendicitis and in all ailments when the diagnosis is obscure. Nor should it ever be omitted before an operation upon anal disorders. It may save the embarrassment of a subsequent discovery that a patient's hemorrhoids, for example, were but an expression of a carcinoma higher up in the rectum.



## THE CHOICE OF A GENERAL ANESTHETIC IN PROCTOLOGIC SURGERY.\*

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I have taken this for my paper for the following reasons:

First, because of the well-known resistance that a large number of proctologic patients show to the effects of a general anesthetic.

Second, that this fact has driven many proctologists to attempt their operations through the aid of local anesthetics, and has brought forth much ambulant treatment and surgery, which I think is ill-advised.

Third, that our peculiar field necessitates operating about and through the most irritable and sensitive circular muscle of the body, and that we labor under the disadvantage of leaving our operative field behind the closed veil of the sphincter muscle without adequate protection against hemorrhage and infection, and entirely at the mercy of the peristaltic ebb and flow.

Fourth, as the result of many years of specialization in anesthetics, there is an intense interest and admiration in the spectacle, somewhat rare but always pleasing, of a safe, quiet and successful anesthesia.

Those of us who in our early days were hospital interns and anesthetists may remember the evil reputation that justly accompanied most proctologic anesthetics. I have never been able to determine just what particular reason was responsible for this fact. I soon learned, however, that when the surgeon divulsed the sphincter muscle, and after the flurry caused by the stretching subsided, the patient always settled down, and from then on the stages were more comfortable and quiet. This led me to institute a series of blood pressure tests taken over intervals corresponding to: before anesthesia, just before divulsion, during divulsion and after. These readings were always marked by an abrupt *rise* of systolic pressure during the divulsion amounting to a minimum of 10 mm. to as high as 60 mm. increase over and above the systolic blood pressure registered before stretching.

This rise of blood pressure was maintained for a considerable period after the divulsion, or until the anesthesia was deepened to a late secondary stage. Without knowledge of the value of rapid divulsion

of the sphincter muscle in respiratory accidents, such as chloroform, poison gases, drownings and accidental electrocutions, in each of which I have seen apparently hopeless respiration started by rapid divulsion, I cannot but hint at a conclusion that the sphincter muscle, so vital in its relation to the sympathetic nervous system, must be a determining factor in the difficulties accompanying general anesthesia in proctology. With these facts in mind, and resting upon the best known surgical principles which were laid down before the era of proctology, I must declare myself against the present day trend towards local anesthesia in our work. The temptations of local anesthesia are great. The repugnance of the American business man to loss of time from his work; the patient's fear of the hospital and the anesthetic; the tendency of some of us against giving the proper amount of time and preparation to the less important lesions, together with the accompanying ease which we enjoy where patients come to our offices and where we can do the most work with the least amount of trouble, are all tempting reasons for ambulant proctology.

To my mind, there are few of our surgical cases that do not deserve general anesthesia as a factor for a quiet field, with an opportunity for thorough exploration and operation upon the sensitive and delicate sphincteric area, and for the opportunity for a complete rest and hospital supervision, which seems to be so necessary for ultimate recovery. All this, I contend, the proctologist cannot attain without general anesthesia.

The various merits of general anesthetics have been a prolific source of controversy by the medical profession. With the reservation that the principles of anesthesia are absolutely unchanged since their first introduction, we have today at our disposal several forms of narcotics for this purpose:

Chloroform, with its friends and enemies;

Nitrous oxid, with its numerous combinations and improved mechanical apparatus;

Spinal narcosis;

Ethyl chlorid, satisfactory in the hands of experts (but experts in the use of this drug are rare);

Ether.

The nitrous oxid group is today upon a great wave of popularity, and in the hands of experts, gives great satisfaction, but is not without its dangers. It is more dangerous than it seems because of the many excuses that can be given for sudden mortality, and because many accidents happen where the news reporter has no access.

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"J. F. Baldwin, Columbus, Ohio, in a report in *New York Medical Record*, July 29, 1916, showed death rate practically 1% in major operations. Following that report, the administration of nitrous oxid for major operations practically ceased in Columbus, but a few months ago, for some reason, it was used in another case, with prompt death upon the table, death taking place, as in the others, suddenly and without the slightest warning.

"Dr. Dennis E. Jackson, of St. Louis, Mo., Associate Professor of Pharmacology, in Washington University Medical School, in an article, *AMERICAN JOURNAL OF SURGERY*, July, 1917: 'Furthermore, I suspect that death may occur under nitrous oxid from depression of the respiratory centers, due to the depressory (later) effects of the gas, coupled with the excess of CO<sub>2</sub>.'"

The disadvantages are many, a few of which, aside from its dangers, are:

The initial expense of a proper apparatus and the gases which it requires; the lack of trained technicians to operate the apparatus; the venous congestion which accompanies the anesthesia is very destructive to a proper judgment of the color of the hemorrhoidal veins which are so evident and constant as an index of nitrous oxid anesthesia.

As to the difficulty of maintaining a quiet patient, which is so important in proctologic work, I quote from an article by Danforth, *Pennsylvania Medical Journal*, March, 1921:

"Gas anesthesia has suffered perhaps somewhat at the hands of its friends. Crile tells us if relaxation is needed, and not at once obtained by gas, to add ether sufficient to produce relaxation. Should this require that much ether be added, we may have a situation which has been characterized by Deaver as 'an ether anesthetic masquerading as a gas anesthetic', the ether doing the work and the gas getting the credit."

With the admission that there are certain special cases that require certain anesthetics, I present, nevertheless, ether of proven quality, given from the original can upon layers of gauze with observance of all the rules of the open drop method, is, to my mind, the safest and best form of anesthesia at our disposal at the present time.

I have given it over 6000 times without a death or resort to resuscitation. I quote from a recent letter from a New York City anesthetist:

"I have used it in nearly 40,000 anesthetics and have yet to have a case in which I felt that another anesthetic would have been better than ether, or even as good. To my mind, ether is the safest anesthetic. In regard to this it has been my duty and my privilege to investigate a large number of so-called anesthesia deaths. I have found a very large number of deaths under nitrous oxid, not one of which has ever found its way into print either by way of descrip-

tion or in a statistical table. The same is practically true concerning my experience with chloroform deaths."

If there is likely to be any accident or special trouble from an ether anesthesia, the warning signs appear far enough in advance of the approaching difficulty to enable the anesthetist to care for the trouble. Deaths under nitrous oxid and also under chloroform take place very suddenly; under nitrous oxid practically without warning, as in most cases under chloroform. The cause of most of the deaths under nitrous oxid, so far as I can learn, has never been determined; asphyxia alone does not seem sufficient to account for it, but that they do take place suddenly and that the patient is never able to be resuscitated, is a serious and alarming fact.

I prefer ether because throughout any operation sufficient relaxation can be had and maintained without detriment to the patient, which is not true when either nitrous oxid or chloroform are considered. Ether can be administered and relaxation carried to any desired degree with practically perfect safety to the patient whereas, in many cases, obtaining perfect relaxation with chloroform would result in death, and the same would be true concerning the use of nitrous oxid. Furthermore, in some cases, relaxation cannot be had at all under nitrous oxid because as a rule there is spasm of the masseter muscles and also of the lower extremities, especially of the leg and ankle.

If ether is admitted properly by the open drop method, and only enough ether administered to keep the patient sufficiently asleep for the operation, there are practically no disturbances of the physiological functions of the body. Nausea and vomiting, according to my experience, are very much less with ether so administered than in the case of an anesthesia with either nitrous oxid or with chloroform. The amount of nausea and vomiting from nitrous oxid is very great, notwithstanding all that is said to the contrary. I have seen enough of it to make me believe that the nausea and vomiting following a nitrous oxid anesthesia are comparable with that which follows an ether anesthesia, if the ether be of inferior quality or improperly administered. If the ether is administered properly by the open drop method, there is, after the removal of the mask, either no nausea and vomiting whatever, or if any occurs, the proportion of cases is very much less than in the case of nitrous oxid or nitrous oxid-oxygen.

The production of acidosis in the patient, that is, the diminution of the carbonates in the system, is very much less under any conditions of ether anes-



thésia than it is under the best conditions of a chloroform anesthesia.

Surgical shock is very much more readily handled in the case of an ether anesthesia than in the case of either nitrous oxid or chloroform, as nitrous oxid does not modify surgical shock at all, while chloroform tends to increase it.

The limited paraphernalia, the easily understood rules of the drop ether system, admit the possibility of quicker training of the novice than any other form of anesthetic.

With the anatomical and physiological peculiarities of the proctologic operative field in consideration, my creed is: *Wherever possible, admit all cases to hospital surroundings and expert surgical supervision and avoid the ambulant "cure-without-operation," rapid-fire office treatment. Employ general anesthesia by the use of ether of proven quality, open drop method, given by a trained anesthetist.*

#### THE TREATMENT OF PRURITUS ANI BY IONIC MEDICATION.\*

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To those who are familiar with the various opinions held by proctologists regarding the etiology and treatment of pruritus ani, and are conversant with the voluminous literature which the subject has produced, the caption of this paper will, perhaps, not awaken an undue amount of enthusiasm, for I venture to say that there is no other single disease which runs so chronic a course and is so extremely rebellious to treatment, and for which such a multiplicity of remedies has been advocated, as pruritus ani.

The chief reason for this perplexity seems to me to be due to the fact that the real cause of this disease has not been known, and it is only within recent times that the etiology has been discovered. It is, therefore, not surprising to find that, prior to the discovery of the cause, about every disease to which mankind is heir has been named as an etiologic factor. This also furnishes a reason for the numerous remedial measures, many of them of no value except as palliatives, which have been employed in the treatment of this distressing disease.

To Murray<sup>1</sup> belongs the credit of establishing the etiology of pruritus ani, and his observations and conclusions, corroborated by other investigators,

prove that the streptococcus fecalis is the causative organism.

This organism invades the perianal skin, penetrating into the deeper layers and setting up a localized infection of these tissues, giving rise to the disease which takes its name from its chief symptom. The manner in which this organism invades the skin is not known exactly, but, from the fact that normal unbroken skin forms an efficient barrier to bacterial invasion, it would seem that the most likely avenue of entrance is through the opening of the glands in the perianal skin. It is also possible that infection takes place through small abrasions at the mucocutaneous junction, caused by the passage of dry, hard feces and also by the use of harsh cleaning materials, such as stiff paper or other irritating detergents. Uncleanliness of the parts must also be considered a factor.

The effect produced by the infection is not an acute inflammatory one, but a low grade process, apparently chronic from the start.

The establishment of the etiology renders the problem of treatment much more simple, to the extent that it enables students of this disease to devote their energies and researches to the therapeutic phase of the problem.

For the purposes of this paper, I have divided cases of pruritus ani into three groups, and it is important that each group be identified etiologically to obtain satisfactory results from treatment. The groups are:

1st. Cases that are caused by infection and in which demonstrable lesions are not evident, and which are likely to derive benefit by measures directed to the removal of the infection. These are the cases that should have antiseptic treatment and they comprise the largest group.

2nd. Cases that present demonstrable lesions and in which treatment of any nature is likely to fail unless what may be regarded as the predisposing cause is removed. Particular reference is made to cases having chronically inflamed crypts, hypertrophied anal papillae, ulcers and small anal sinuses, described by Beach<sup>2</sup> and by Terrell<sup>3</sup>. Undoubtedly there are other conditions that predispose to the disease, which must be identified and removed before satisfactory results can be obtained.

3rd. In this group should be mentioned cases of anaphylactic origin which, although not as common as those in the preceding groups, do occur with sufficient frequency to warrant classification. I have seen one such case in which intense pruritus was caused by eating apples. Omission of this fruit from

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the diet was followed by complete relief. Other cases have been reported in which pruritus followed the ingestion of different foods.

Before proceeding with the subject of treatment of pruritus ani by ionic medication, a few brief remarks should be made concerning ionization. The term is used to describe that form of treatment which consists of the introduction into the tissues, by a current of electricity, of one or other of the constituents of the chemical compounds known as salts.

When a substance is dissolved in water, the force of cohesion between molecules is overcome and the molecules become uniformly dispersed throughout the solvent. In the event that the molecules themselves do not dissociate or split up into their component atoms, we have what is known as a molecular solution. Such a solution is a non-conductor of electricity and is of no value in ionization work. Alcoholic solutions are non-conductors and are, therefore, valueless. When a solution of a metallic salt is dissolved in water and the solution acted upon by a current of electricity, an electrolytic action takes place in which the ions of the dissolved salts are set free and conduct and move along with the current in a definite direction and are attracted by one or other of the poles. Those which are repelled by the positive pole are called electro-positive and those repelled by the negative pole, electro-negative.

It is a well-known fact that the ions liberated by such electrolytic action on solutions of metallic salts, notably of zinc, copper, mercury, iodine, and many others, have marked antiseptic properties. These, according to Leduc<sup>4</sup> can be driven into the tissues to a sufficient depth to make them effective in the treatment of infectious conditions, such as the one under consideration where the offending organisms are below the surface and out of reach of the usual ointments, lotions, etc., applied for the relief of the disease.

Jones<sup>5</sup> states that substances introduced ionically enter the actual cells which would not be the case if the solutions themselves were injected hypodermatically. In the latter case, the fluid would enter and be dispersed principally throughout the interstices of the connective tissue and be quickly eliminated by the lymph stream. Moreover, considerable irritation would be produced by this manner of administration.

Ionic treatments require a direct current or one flowing constantly in one direction, the voltage of which should not exceed 50.

The apparatus I use consists of a portable motor transformer which generates a low voltage direct current. This is connected with a milliammeter,

the function of which is to enable the operator to control the electric current so that it can be applied very gradually and without the slightest break in the circuit and also to indicate the amount of current used. From the milliammeter the wires run to the electrodes. To enable the operator to distinguish the positive from the negative wire, which is of very great importance in this particular instrument, they are colored red and green respectively.

For ionic applications, two electrodes are necessary. One is a sheet of brass or lead about 18 cm. square, with a suitable binding post soldered to one side. This electrode must be covered with several thicknesses of cotton flannel securely sewed at the edges, leaving exposed only the post for the attachment of the wire. This is the negative or indifferent electrode and serves to complete the circuit.

The active electrode, or the one to be applied to the part under treatment, is made of a circular piece of brass or copper about 6 cm. in diameter with the handle soldered to the center and also fitted with a binding post. The circular disk is bent in such manner that it will fit into the fold between the nates and come in contact with the peri-anal skin. The electrode is to be covered with a thick layer of absorbent cotton which can be thrown away after use.

The following aqueous solutions have been found useful in the treatment of these cases:

1. 1% zinc sulphate.
2. 1% zinc permanganate.
3. 1% mercury oxycyanide.
4. 1% iodine (Lugol).
5. 1% potassium iodide.

The first three of the above are electro-positive and must be applied with the positive pole connected to the active electrode. The solutions of iodine are electro-negative, requiring application with the negative pole.

The manner of applying the treatment is as follows:

The patient is placed on the table, lying on the side, with thighs well drawn up. The large electrode, previously moistened with warm saline solution, is applied to the abdomen and held in firm position by the patient. The active electrode, with its absorbent cotton covering well saturated with a warm solution of the salt, is firmly pressed against the area to be treated. The current is then turned on to the motor transformer and the button on the milliammeter turned until the needle shows the current flowing. This should be increased gradually until the patient feels a warm sensation. As much current should be used as can comfortably be borne, usually about 10



ma., and the application should continue from fifteen to twenty minutes. At the end of that period the current is gradually reduced to the zero point, bearing in mind not to remove the electrode until that point has been reached. By observing this precaution, the patient will feel no unpleasant shock. This treatment is absolutely safe and cannot cause a burn or destruction of tissue. Except in severe cases, when a daily treatment is indicated, the applications are made three times a week. When the pruritus is brought under control, the latter treatment is sufficient.

At the beginning of the treatment, the solutions should be diluted with distilled water to  $\frac{1}{2}\%$ . After a few of these applications, when the skin has become more tolerant, the 1% solution should be applied. There is a distinct disadvantage in using strong solutions, because irritation of the skin must be avoided. It is most important that the parts be perfectly clean and free from any ointments before the application is made, as a greasy skin is a poor conductor.

Regarding the question of what solution to begin with, I think it may be stated as a general working rule, that in cases with irritated, moist, blanched skins, the milder of the zinc solutions, namely zinc permanganate, is indicated. If the case does not progress satisfactorily under this application and no improvement in the appearance of the skin is apparent, then the oxycyanide of mercury should be tried. The iodine solution seems to work better in cases where the skin is dry, thickened and fissured. There is really no hard and fast rule for the use of any of these solutions. One skin is more tolerant than another and it may be found necessary, in an occasional case, to use one after another of the solutions before satisfactory progress is evident. The above order of use has, in my experience, met the indications. Improvement in the appearance of the skin, less moisture, a gradual disappearance of the blanched areas and less induration, are the outward evidences of satisfactory progress.

After a few treatments, usually after one, the itching becomes more controllable and does not require the digging and tearing of the skin, as was the case before. While the pruritus does not disappear completely in this short time, the attacks are of shorter duration and the intervals between them is lengthened.

Secondary infections due to trauma of the skin by scratching gradually subside as the pruritus is relieved.

As a result of the bacterial infection of the skin, certain well defined changes take place in it, notably the formation of an exudate which, as time goes on, becomes either absorbed and disappears, or what is more common, causes a hyperplasia of the connective tissue elements.

It is my belief that this change in the histologic structure of the tissues is the important cause of the chronic nature of the disease with its persistent pruritus, and that this exudate, either wholly or partially organized, acts as an irritant to the sensory nerve endings. Microscopic examination of sections of skin, taken from cases of pruritus ani, show the histologic changes referred to.

The introduction of antiseptic ions has not only a bactericidal effect, but a lytic one as well, and I am convinced that not until the exudate is softened by lysis and resolution is complete, is permanent relief from pruritus to be expected. The destruction of the organisms is, therefore, only a part of the plan of attack, and must be followed up by treatment directed toward restoring the tissues to a normal condition. My experience with this method of treatment leads me to the conviction that, in the majority of cases, it accomplishes these results if faithfully carried out. Omission of treatment should not be permitted even if marked relief of pruritus follows, but should be persisted in until objective signs of improvement are evident, and then it is advisable to continue the applications for a few weeks after the disappearance of all itching. While it is a difficult matter to get private patients to do this, it is infinitely more so in the case of hospital patients, whose discomfort may not be enough to warrant the loss of time involved, and who fail to report for treatment regularly.

In reporting the results of treatment of pruritus ani by ionic medication, it is quite impossible, in a brief paper, to speak of individual cases, so that more or less generalized statements must be made.

In a previous article<sup>6</sup> I reported thirty cases of pruritus ani treated in the rectal clinic of the Boston Dispensary. In that series were six cases which received an average of 15 to 20 treatments, and which were free of itching three months after the treatment ceased. Since that report was made, I have been able to trace eight others of that series, making 14 in all, in which the end-results are known at the expiration of 18 months. Nine report no itching, and 4 say that they have very little trouble. The remaining case, although better, still has some itching and has been advised to return for further treatment.

Since January, 1920, 15 private and 25 dispensary



cases were under treatment and have been selected for study. I have had to throw out of consideration many cases because of irregularity of attendance, so that this small series is fairly representative of patients who have submitted to treatment according to directions. Of the 15 private cases, 12 are men and 3 women. Four of the men had involvement of the scrotum and 1 woman had pruritus vulvae and ani. In this group the disease averaged 7 years in duration. The average number of treatments given was 60, or 3 per week, of 20 minutes' duration, for a period of 5 months.

The results in these 12 male patients are as follows: Seven are free from itching at the present time. Three have one attack per day which is controllable by rubbing, no scratching being necessary. Two report a few very slight attacks during the day. All of these patients are able to sleep at night without interruption.

Of the 3 women patients, one is well and has had no trouble since. Another has but one short attack per day which is controllable and not troublesome. The remaining case is one of pruritus vulvae of seventeen years' standing, which is still under treatment. Her case is complicated by a profuse leucorrheal discharge which keeps the parts moist and macerated. She is receiving two treatments of 20 minutes' duration per week. On account of the inflamed condition of the parts, a weak zinc permanganate solution is being used. Although much improved, she still has one vicious itching spell, lasting about two minutes shortly after retiring and usually two milder attacks during the day. I feel that permanent relief cannot be expected in this case until the discharge from the vagina ceases. I have referred her to a gynecologist for this complication. In this connection it is interesting to know that this patient, prior to coming under my care, received 57 injections of an autogenous vaccine, with but temporary benefit.

Regarding the 25 dispensary cases, 17 have been under treatment for six months, receiving three treatments per week, of five minutes' duration. They should have had longer applications, but it was impossible to afford the time to carry this out. The remaining 8 cases were under treatment for about 4½ months, receiving on an average two treatments per week, of five minutes' duration. Among these were three women with pruritus vulvae.

Since the cessation of treatment of the 17 cases cited above, 8 have been apparently cured. In the remaining 9 cases, 5 have but a short mild attack in twelve hours, while 4 have two or more attacks and

require further treatment for entire relief. One of these patients has large skin tags which should be removed as they interfere with proper cleaning of the parts, but operation has been refused.

Included in the remaining 8 cases under treatment for about 4½ months, are 5 cases of pruritus ani and 3 of pruritus vulvae. The 5 cases of pruritus ani, although greatly relieved, are not entirely free from itching, having two or more attacks in twenty-four hours. The patients state that the discomfort is not as severe as before treatment began, and all are showing steady improvement. Of the 3 cases of pruritus vulvae, which were of a mild type, 2 are practically well. The remaining case is one of ten years' standing and which was operated on four years ago for the removal of the right major lip of the vulva, which was greatly thickened, indurated and itched intensely. The partial vulvectomy was of no benefit whatever. The woman has been under treatment for 4 months, receiving 3 treatments per week. The thickening of the labia is markedly reduced and the leathery feel of the tissues is much lessened. Coincident with these changes is a diminution of the amount of itching and the patient now has two attacks at night and about three by day, whereas formerly she has had 10 or more attacks in twenty-four hours. She is being treated with weak iodine solution alternating every other treatment with a 1% solution of potassium iodide.

Such is the brief outline of the results of treatment of these cases of pruritus ani, scroti and vulvae. This series of cases, although not large, is I believe, sufficient to show the value of this method of treatment in these distressing conditions.

One other detail of treatment not touched upon is the great importance of cleanliness. This is the sine qua non of success, for an unclean condition of the parts not only retards favorable progress, but will surely contribute to reinfection.

No antipruritic ointments, lotions, etc., are used as I have found that the use of ointments, particularly, lessens the conductivity of the tissues and in a great measure nullifies the treatment. The use of an inert dusting powder, such as plain talcum, is indicated and in fat individuals the interposition of a layer of absorbent cotton between the nates is of advantage.

In treating this disease patients must be frankly told that the treatment must be of long duration and that a cure is not to be expected immediately, but great relief can be promised after a few treatments.

I have not had the opportunity to study the question of the lowered resistance to streptococcal infection.



tion which Murray states is found in cases of this disease. I should say that the determination of the opsonic index would be necessary in cases undergoing treatment with vaccines, so as to observe the effect of the type and dosage of the vaccine. The whole problem is one of much scientific interest, and I am particularly desirous of learning what effect the destruction of the causative organisms by ionization has on the phagocytic power of the blood. I intend to pursue this investigation at the earliest opportunity.

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## POST-OPERATIVE COMFORT IN RECTAL CASES.\*

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The layman frequently fears post-operative pain more than the operation itself, thanks to the reports—often highly colored—of his friends and neighbors who "have gone through the ordeal". We, in a great measure, are responsible for this state of affairs, because in the past we have paid too little attention to post-operative comfort. The use of the words "painless", "no chloroform", "no knife" is the chief asset of the advertising specialist, who realizes what the patient wants and gives it to him in promises, despite the fact that his victims usually suffer intensely after treatment. It is incumbent upon us to eliminate, as far as possible, all pain and suffering following, as well as during, operation. When the success of our efforts in this direction has become generally known, fear of rectal surgery will to a large extent disappear.

With this end in view, our best efforts must be directed to perfecting present methods, which may be grouped as follows:

1. Preparation of patient for operation.
2. Selection of an anesthetic.
3. Special technic of operation.
4. Application of dressing.
5. After-care.

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## PREPARATION OF PATIENT FOR OPERATION.

The preparation of the patient for operation should be psychological as well as physical. If he is nervous and apprehensive, it is not out of place to remind him of his suffering in the past, and, when warranted, of the possibility of a continuance or recurrence thereof, if his present condition is allowed to persist. Assure him that following operation his nervous condition will improve and that in comparison with what he has already endured, his post-operative discomfort will be only slight and of short duration.

I am convinced that the patient who has had his intestinal tract thoroughly emptied, has a happier convalescence than one who has been indifferently prepared. The annoyance of having the field of operation soiled by a flood of feces is well known to the surgeon. After operation, the tenesmus from the same cause is very distressing to the patient. Therefore, the colon should receive most careful attention before operation.

Unless there is some degree of obstruction, a clean bowel can be secured in nearly every instance. To accomplish this, two nights prior to operation 30-75 cc. of castor oil is given, followed the next morning by a seidlitz powder, which it is often advisable to repeat in an hour. During the day a liberal quantity of fluids and bicarbonate of soda are given. In the late afternoon the bowel is washed out with as many enemata of plain water as are required to get a clean return. Such a procedure does not cause discomfort for the reason that the cathartics are given in sufficiently large doses to make the evacuation quick and complete, instead of inciting the bowel to frequent and ineffectual action, such as results from small doses. During the day the field of operation is clipped or shaved. Thus, before evening, the mechanical part of the preparation is complete, and the patient is comfortable. Usually he goes to sleep promptly. If he is wakeful, sleep is induced by veronal or trional; if in pain, he is relieved by codeine or morphine. Restful sleep is one of the best fortifications for operation.

If the patient does not wish to enter the hospital until the morning of the operation, the above preparation may be carried out at home. He will, as a rule, however, feel less nervous if he enters the night before and becomes accustomed to his surroundings.

By the aforesaid method the patient's intestinal tract has been thoroughly emptied and he has had plenty of fluids and alkali. As a result, he takes his anesthetic well, post-operative vomiting is min-



imized, acidosis is prevented and comfort is enhanced. Formerly this plan was followed in preparation for the more extensive operations, but finding the conditions for operating so favorable and the patient's convalescence so much more comfortable, it is now employed whenever time and opportunity permit, modified as occasion demands.

#### SELECTION OF AN ANESTHETIC.

The various anesthetics are now so well known to laymen that many patients specify the one desired, in Buffalo the choice being overwhelmingly in favor of gas and oxygen. Effort is made, however, to choose the anesthetic best suited to the temperament of the patient and to the operation to be performed. A local or general anesthetic is preceded by a dermatic injection of 1-8 to 1-6 grain of morphine sulphate one and one-half hours before operation, and 1-8 to 1-4 grain of the same drug with 1-200 grain of hyocine hydrobromide an hour later.

Gas and oxygen contribute to the comfort of the patient, not only during its administration, but also after operation. Sometimes it is necessary to add a little ether to the gas to secure complete relaxation of the sphincter and a light color to the blood, although many anesthetists are able to accomplish this with gas and oxygen alone. It is highly desirable to have one's own anesthetist who understands the different shades of anesthesia required.

Sacral anesthesia is employed in the tuberculous and in old and feeble patients, and local anesthesia where one is certain that he can satisfactorily operate not only on the main surgical condition, but also on the complications so often associated therewith.

#### SPECIAL TECHNIC OF OPERATION.

It is not generally necessary to divulge the external sphincter. When it is, it should be done gently and slowly in order to avoid tearing the muscle fibers, as this damage, together with the extravasation of blood in the bruised tissues, is often a factor in producing discomfort. Other injury to this muscle during operation should be avoided where possible, to prevent spasm of this muscle later.

One must be certain at operation to remove all folds of skin, skin tags, polypi, or hemorrhoids, as these are likely to fall into wounds, and, by keeping the edges apart, delay healing and prolong irritation.

When a fold of the lining of the anal canal is excised, the incision is made far enough outward from the orifice to afford complete drainage until healed. This usually precludes the formation, at the outer extremity of the wound, of an edematous, painful and perhaps infected tag of tissue. For the same reason, back-cutting is done in fistulae and fissure operations.

The undermined and infected lining of the lower rectum and anal canal, associated with ulceration, fissure or fistula, as demonstrated by Hanes, must be removed completely. Methylene blue stains this area readily and facilitates its orientation and complete removal.

During operation avoid, as far as possible, retraction by hook retractors or clamps on the skin, a better method being to have assistants retract with gauze-covered finger tips.

Avoid ligatures on bleeding vessels near the skin.

A smooth, clean and untraumatized incision made with a sharp knife or scissors heals quickly and gives little after-pain.

A portion of a fistulous tract that has been overlooked at operation often causes after-pain.

When completing an operation, clots in the internal and external hemorrhoidal areas should be carefully searched for and evacuated, and puncture wounds should be made in edematous tissue.

Before the dressing is applied, one should be sure that the rectum is free from feces, blood or any fluid used for irrigation, as these, if allowed to remain, are likely to cause pain and urgent desire to defecate.

For the prevention of post-operative pain, the greatest single means we have is quinine and urea. On the completion of every operation, no matter what anesthetic is used, all cut edges are injected with a 1-3 of 1% quinine and urea solution. Owing to its prolonged action, the patient is comparatively comfortable over a period of from three to six days, after which time there should, in most cases, be little or no suffering.

#### APPLICATION OF DRESSING.

The dressing is important. An ideal dressing should, by gentle pressure, splint the anal canal and control bleeding. It should be soft and pliable, exerting no rigid pressure on surrounding structures, such as the bladder, prostate and ovaries. Above all, it should be easily removed. These ends are attained by using a strip of four-ply gauze, two or three centimeters wide and sixty centimeters long, lengthwise through which is sewn a strong double puckering string. Just before using, this gauze is dipped in melted petrolatum. Should there be danger of bleeding, the greater portion of the strip is put into the rectum; if there is no such danger, only a small portion is inserted. On account of the petrolatum in the gauze and the mucus secreted by the mucous membrane, the part in the rectum never adheres. Even the petrolatum-gauze, however, because of its meshlike texture, will adhere to cut surfaces and cause pain during removal. This pain



can be absolutely avoided if the gauze be separated from all cut surfaces by means of a piece of oiled silk or cellosilk. A convenient method of procedure is to use a piece of the silk, twenty centimeters in diameter, with a small hole in the center. Pass through this hole and on into the rectum as much of the gauze as is intended for the rectum. Then push the center of the piece of silk to the upper end of the wound in the bowel, thus forming a funnel of silk with petrolatum-gauze in the center. Into this funnel pack the remainder of the gauze lightly. When packing the gauze inside this funnel of silk, endeavor to press inside of the external sphincter and all tissues that have been everted during division of that muscle, so as to prevent edema, swollen skin tags and after-pain. Over this, pack dry fluffed gauze, and apply a T-bandage to make compression and keep all in place. Where the T-bandage passes over the sharp edge of the adductor longus in each groin, place a towel to avoid undue pressure.

Should post-operative hemorrhage occur, a method of arresting it, which is not new, is to pull upon the puckering string which runs through the vaseline-gauze, thus causing the gauze to fold into a mass in the lower rectum just above the external sphincter; then, by tying the ends of the string over another wad of gauze on the outside of the sphincter, tight compression is made on the bleeding point, and the sphincter, contracting, increases the compression.

When the patient is properly prepared there is comparatively little post-operative trouble with gas. However, should it cause irritation, the patient can readily pass it along-side the non-adherent silk, and he will do so if assured it will not cause pain. A large rubber tube or rectal plug is never used for this purpose, although in rare instances it may be advisable to insert a small soft rubber catheter after operation, and this can be accomplished painlessly on account of the quinine and urea anesthesia.

#### AFTER-CARE.

Morphine given after operation before the patient is conscious of pain, starts him on his convalescence without his having experienced any initial post-operative suffering, and in this way his fear is banished and he is inclined to minimize further pain.

At the first indication of nausea or vomiting, following anesthesia, the patient is encouraged to take at one draught a sufficiently large quantity of water to induce free vomiting. This lavage usually gives quick relief. After this he is permitted to have fluids ad libitum, and soon ice cream, cream of wheat, custard, junket and the like. As soon as the bowels have moved he is allowed soft diet.

From two to six hours after operation, if there is no fresh bleeding, all external dressing—possibly blood-soaked and stiff—is removed, leaving only the petrolatum-gauze and silk. A single compress then replaces the dressing removed, and the patient immediately experiences relief. Thus relieved, he is soon thereafter encouraged to urinate. This is usually accomplished with ease, either lying in bed, on a commode, or standing if necessary. Catheterization is practically never necessary. Should the patient, however, be unable to urinate, the discomfort of a distended bladder should not be permitted and is usually avoided, if there is no bleeding, by removing the remainder of the gauze dressing, which may be a factor in the reflex stimulation that is the cause of the retention. When there is no retention of urine, the petrolatum-gauze is allowed to remain until the next morning. In abscess cases the dressing is usually not removed for two or three days. Seldom is any pain experienced on the removal of such a dressing. Should there be pain, hot fomentations of a saturated solution of magnesium sulphate or boracic acid, or plain water, will give quick relief.

Hot sitz baths, for the relief of post-operative pain, are most effectual and may be given any time after the first day. Even when pain is slight, they often act as a sedative and add greatly to the comfort of the patient.

Any complaint of pain by the patient should be investigated at once. Sometimes inflamed and painful skin tags, which cannot always be prevented, form soon after operation and should be removed. The patient usually objects to any more anesthesia, and, in most instances, it is unnecessary. From the quinine and urea and from the edema which frequently follows operation, anesthesia is present to a greater or less extent and can be augmented by painting, with pure phenol, a streak where the incision is to be made. To make the incision, a pair of very sharp scissors is used, one blade of which, serrated, holds the tissue so that an accurate cut can be made, thus obviating a second one. This is practically painless during the first three to five days, and, in some cases, even as late as ten days, depending upon the sensitiveness of the patient, the gentleness of the surgeon and his ability to divert the patient's attention. Local anesthesia should be used, however, when the patient is very nervous.

When the daily administration of fifteen cubic centimeters of liquid petrolatum before each meal is begun on the second or third day after operation, there is usually a fairly normal and comfortable bowel movement about the fifth day, or this can be



induced by an enema of warm water given through a male catheter. The use of oil per rectum is not necessary when it has been given by mouth. After the first defecation, if there is any tendency to hard stools, five to ten grams of agar agar is given with each meal. Castor oil may be given the third or fourth day if the patient experiences sufficient abdominal discomfort to indicate it. His sleep is not disturbed if it is given about 10 p. m.

When ligatures are used in the treatment of hemorrhoids and are allowed to protrude from the anus, at each dressing care is taken to see that these remain in the center of the orifice and not in a fissure or other wound. Although some advocate cutting these ligatures short, my experience has been that the long linen ligatures, if pulled upon gently, can be removed from the sixth to the eighth day, which removal is from three to five days earlier than when they are allowed to slough off, as they are when cut short. Thus the irritation due to the sloughing stump is stopped more quickly. Following the removal of the ligatures, a finger passed into the anal canal breaks up adhesions and granulations which tend to interfere with proper drainage and normal function. This, when followed by a warm enema or sitz bath, affords additional comfort.

For the dermatitis that sometimes occurs about the anus, due to the discharge from the wound, a saturated solution of boracic acid should be used as a wash, and compound stearate of zinc powder dusted on. If there be itching, it can usually be relieved by substituting for the boracic acid wash a three to five per cent solution of carbolic acid followed by the same powder.

Silver nitrate, when used in the destruction of extensive granulation tissue, frequently causes pain for many hours after its application. A sharp small curette will serve the same purpose with only slight temporary pain, or none at all, if wound edges are avoided.

In my experience another procedure that has proven especially useful in the prevention of suffering during convalescence has been to have the patient, himself, evert his anal orifice several times daily by pulling the buttocks apart with his hands. This prevents the outer end of the wound healing before the inner and maintains good drainage.

Many of the details of the methods outlined in this paper may appear trivial and unimportant, but it has been my experience that it is careful and painstaking attention to just such details that constitutes the essence of success in attaining a speedy and practically painless cure of rectal conditions.

Upon a rapidly widening circle of appreciative patients, thus cured, depends the enlightenment and education of the public, which will lead other sufferers to promptly and fearlessly consult legitimate practitioners.

## THE PRINCIPLES OF GASTRO-RECTO-ENTERIC SURGERY.\*

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It is characteristic of modern surgery that it is dominated largely by physiology, and this is particularly the case with surgery of the gastro-recto-enteric tract. For this reason, the principles to be considered here are taken from the physiology of this structure.

A principle of surgery is a scientific fact upon which are based the methods, rules and technic used in surgical operations.

The rules, purposes and technic of surgery may change, according as the importance of one surgical principle or another may happen to be accentuated, but the principles do not change. This paper will be confined to a discussion of some of the more important principles that play a rôle in the surgery of the gastro-recto-enteric tract.

There is another point to be mentioned in this introduction, and that is, that while there are obvious differences to be noted among the various structures that make up the gastro-recto-enteric tract, the same basic morphology and basic physiology persist throughout. The truth of this becomes more evident by a consideration of the principles to be enumerated.

### *First Principle:*

One of the basic functions of the gastro-recto-enteric tract is to provide a passageway for food and food residue, and to propel them to their destination. This function is common to all parts of the tract. This fact of physiology is so plain, and its bearing upon surgery of the part is so obvious, that its demands upon surgical technic have always received consideration. However, the extent of this consideration has varied and there is a tendency to attach more and more importance to this passageway function. One of the rules that have grown out of this principle has to do with the preliminary operations used to establish enterostomies or anas-

\*Read before the American Proctologic Society, June, 1921.



tomoses that functionate before an intestinal or rectal resection. It is the exception, at the present time, to excise a portion of the tract for cancer or other lesion without a preliminary operation for the maintenance of a clear passageway.

The same principle demands the exercise of precautions for the prevention of post-operative adhesions. Unfortunately, this subject is not yet sufficiently understood to permit the formation of standardized rules. It is known, however, that surgical trauma, especially to the peritoneum, is provocative of adhesion formation. It would seem, also, that the use of large quantities of suture material may be a pernicious factor. Sometimes the operator, in his zeal to cover up every injured area and stop all oozing, produces kinks and adhesions that subsequently result in intestinal obstruction.

However, it is not my purpose to dwell on questions of surgical technic, but merely to draw attention to the unobstructed lumen of the gastro-recto-enteric tract as a biologic fact and a fundamental principle of surgery. Any surgical procedure that interferes with or violates this principle must be considered unscientific and dangerous. In the surgery of the stomach the principle is easy to apply: A gastro-enterostomy, or a pyloroplasty will supply a large free passage.

The same purpose is accomplished in the intestine by a preliminary colostomy or side-track anastomosis. When the intestinal tumor can be brought out through the incision for subsequent removal, there is presented a most favorable outlook. In cases of partial or complete extirpation of the rectum the same principle demands recognition in a preliminary colostomy.

Provision for an unobstructed passageway has precedence over every other factor in the surgery of this structure.

### *Second Principle:*

When the wall of the gastro-enteric tract is incised, each of its three coats manifests its own peculiar characteristic:

1. The cut edges of the peritoneal coat show a prompt tendency to form adhesions with other portions of peritoneum or with surrounding structures.
2. The muscular coat retracts, showing a tendency to make the wound gap more widely.
3. The mucous membrane is redundant and is inclined to protrude.

The characters are, therefore, adhesion of the per-

itoneal coat, retraction of the muscular coat and protrusion of the mucous coat.

Insofar as the mechanism of anastomosis, fistulae and the mechanical portion of the technic is concerned, these are the characteristics to be considered.

It would follow, from this principle, that each of the three structures that make up the wall of the gastro-recto-enteric canal should receive surgical treatment especially adapted to its peculiarity.

In a general way, it may be said that this principle necessitates the approximation of these layers, layer by layer, and does not warrant through and through sutures.

It is scarcely necessary to refer to the wonderful adhesive faculty of the peritoneum. Adhesions of the peritoneum form the most important process in the control of peritonitis. I would hazard the statement that, notwithstanding our efforts to evacuate abdominal abscesses surgically, the majority of these abscesses are evacuated into the intestine by natural processes in which peritoneal adhesions act as the surgeon-in-chief.

The serious consequences of perforating ulcers of the stomach and duodenum are often controlled by adhesions. In the case of colostomies, fistulae and other forms of drainage, the surgeon can depend upon the formation of a secure canal within twelve hours or less. Accordingly, drainage tubes need not remain for any great length of time unless demanded for other reasons.

When there is no interference from knife or suture, grave troubles in the abdomen are taken care of by the peritoneum. When an abdomen is opened and the surgeon takes charge, if he is wise he will not forget to retain the services of this structure.

We have learned not to break up adhesions around an appendicular abscess, but rather to encourage adhesions by drawing the omentum into the surgical field.

The adhesive power of the peritoneum is undoubtedly physiologic, but it is a power closely allied to instinct. As far as the peritoneum is concerned, unabsorbable suture material is entirely unnecessary, and I believe a true appreciation of this principle will lead to the use of less sutures for the approximation of peritoneal edges. The mucosa does not readily form adhesions. However, its cut edges will grow together or to the cut edge of the skin. The submucosa is loosely attached to the basement membrane and the mucous membrane is thus enabled to move about in quite wide limitations. It is the inner tube, much too large for the two outer tunics, and



it is thus thrown into folds. Consequently, when the wall of the intestine is cut through, the mucous membrane protrudes through the opening, and may keep on protruding till it meets other mucous membrane or skin. This is the feature that must be considered by the surgeon. The propensity to protrusion can, and must be controlled by sutures, and by inverting the approximated edges. However, the chief factor in opposing and controlling the rebellious mucosa is the firm adhesion of the peritoneum. The muscular coat accommodates itself to the status, established after the battle between the mucosa and serosa is ended. Gaps in the mucosa are more or less controlled by muscular contractions, or completely by the production of fibrous tissue.

#### *Third Principle:*

Physiologically, bacteria are always present in the colon and may be found in any portion of the gastro-recto-enteric tract. It follows from this that contamination of the surgical field is to be considered when any portion of the tract is opened.

Quite often the stomach, the duodenum and the upper portion of the ileum are free from micro-organisms. The rectum contains large numbers of bacteria but they are normally in an attenuated condition. The practical consideration is that, when any portion of the tract is opened pathogenic bacteria may be present, and there is no practicable method of determining that, in a particular instance, they are absent.

The surgical principle demands that every precaution should be taken to prevent, as far as possible, the spread of the contents of the viscus to the surrounding tissue.

In view of the principle that in the surgery of the tract every field must be considered infected, the question arises: what measures must be adopted to prevent danger from this source. In the first place, it is a well-established fact that much depends upon the amount of infection, and every effort should be made to limit the escape of the contents of the viscus and to protect the surgical field from extensive contamination.

It is also demonstrable that blood clot, detritus and dead tissue form culture media for the propagation of bacteria. In this connection, the question of drainage arises.

#### *Fourth Principle:*

The three surgical principles so far mentioned are biologic facts. We may not agree absolutely upon the rules or technic to be adduced from them,

but as principles they remain unchanged. However, there are certain problems that confront a surgeon in which the principles are not definitely established. Physiologic research has not yet unfolded all the facts that have a bearing, and often a vital bearing, on the work of the surgeon. Under these circumstances, it is necessary to be guided, as far as possible, by experience, and to be governed by what seems to be the most reasonable and consistent theory at hand. I have in mind the clinical subject of post-operative ileus and what is generally associated with ileus, surgical shock. The patient begins to "go bad" within a few days after the operation. The blood pressure drops; the pulse grows rapid and feeble; vomiting is present, the vomitus being dark and copious; distention occurs; and there is no movement of the bowels. Sometimes a secondary operation is performed. Generally the patient dies within a week. It is known that at the center of the trouble is ileus, a dilated portion of the intestine which is practically paralyzed. The stomach is often affected by the same condition. There is adsorption, the fluid pouring into the affected intestine from the surrounding lymphatics. The surgeon's inability to do much for these patients depends upon the fact that he is still in doubt as to the real condition. Why does the blood pressure decline so suddenly and persistently? Why should a portion of the intestine suddenly lose all muscular tone and become parietic? What is the source of the toxins in the case? Research workers have given answers to some of these questions, but as yet, the main problem must be considered unsolved. While we must wait for physiological research to clear up this question, surgeons are compelled to make what use they can of known physiologic and clinical facts in order to have some principle upon which to proceed in these cases. On a status of this description is the theory or principle which I wish to present here:

My fourth principle, therefore, is tentative and may be stated briefly as follows:

Intestinal peristalsis is the main and essential factor in the maintenance of hepatic function. The blood flow in the portal vein depends upon gastro-intestinal peristalsis and the secretion of bile depends upon the portal current. Experiments have shown that about one-fifth of the normal amount of bile is secreted when the portal vein is tied. Apparently, there must be a certain rate of flow in the portal vein to maintain activity in the liver cells. Physiologists seem to be agreed that a certain rate of portal flow is a necessary condition to the secretion of bile. That



gastro-intestinal peristalsis is the main factor in keeping up the portal current does not seem to be so definitely established, but anatomically, the relation of the portal radicles are such that peristaltic contractions must impel the blood into and along the portal veins with a very considerable force.

There is at least very strong presumptive evidence of a scientific nature in support of the theory that intestinal peristalsis maintains hepatic function. From a clinical point of view there is probably no phenomenon more commonly observed than the rapid clearing up of mild biliary symptoms, after the stimulation of intestinal peristalsis by some cathartic medication. The theory is quite in keeping with philogenic facts, for in the lower animals, the intestinal musculature not only impels the contents of the alimentary tract onward, but contraction acts, the same as the heart, and maintains the circulation of the blood.

It is therefore quite in keeping with philogenetic facts to find the intestinal musculature entrusted with a portion of the circulation.

The liver is evolved from the elementary tract and as such is most intimately connected with the intestine, and the secretion of bile is adjusted to suit the varying conditions in the gastro-intestinal tract.

This conception of the relation between intestinal peristalsis and the secretion of bile affords a practicable and reasonable explanation of the clinical phenomena of post-operative ileus and shock. The intestinal paresis is quickly followed by portal stasis and cessation of liver function. The failure of the liver to secrete bile produces a rapid toxemia, affecting especially the brain and causing prompt degenerative processes in its cells. This toxemia, together with the pathologic changes in the brain, account for the rapid decline in blood pressure and the other grave symptoms that are found in post-operative ileus.

One of the most remarkable phenomena in these cases is the rapid collection of fluids in the stomach and upper intestine. Notwithstanding the fact that no fluids are given, large quantities of dark fluid can be withdrawn from the stomach every few hours. What is the source of this coffee ground fluid, and why does it collect in the stomach in these cases? There can be only one source for the fluid. It must come from the tissues by a sort of reverse flow through the lymphatic channels, what is termed adsorption. Why should this remarkable reversion of function take place in this condition? Why should

fluids suddenly begin to flow back into the intestine and stomach? Under certain pathologic conditions, fluids collect in the knee, pleural cavity and abdomen, and we can understand that these collections of fluids serve a certain purpose in these cases. I believe it can be affirmed that in all pathologic conditions to be found in the animal organism there are attending processes which represent an effort to arrest, modify, or in some way mitigate, the destructive forces at work. It would seem that the drainage from the tissues into the bowel and stomach, in these cases, is an effort to withdraw from the system the highly toxic substances present. The intestinal and gastric mucosa strives to take up the function of the liver. This explanation is to some extent theoretical, but it is supported by biologic and clinical facts that raise it somewhat beyond a mere hypothesis.

For example, it has been demonstrated by experiment that mucosa of the affected bowel in ileus contains highly toxic material. It is also to be noted that embryologically and philogenetically, the liver cells are developed from the mucous cells of the elementary tract. It is in keeping with biologic laws that when the highly differentiated hepatic cells should fail, as they do in ileus, the parent cells of the elementary tract should come to the rescue. The interest in this to the surgeon is in the prevention and treatment of post-operative ileus.

The following rules would seem to be warranted:

1. Avoid severe catharsis in the preparation of the patient.
2. Avoid, as far as possible, surgical trauma of the gastro-recto-enteric tract.
3. Evacuate the fluids that collect in the stomach and upper intestine in post-operative ileus.
4. Get fluid into the system by hypodermoclysis, injections, or other methods.

The principle is that hepatic function depends upon intestinal peristalsis.

It follows also from this principle that in the milder form of deficient peristalsis, such as stasis, the evil effects are not so much the prolonged retention and increased absorption, but rather the decreased liver function resulting from the deficient peristalsis.

To recapitulate, I have attempted to present in this paper three principles of gastro-recto-enteric surgery:

1. That a vital function of the gastro-recto-enteric tract is to provide a passageway for the food and food residue.



2. That, normally, the tract contains infective bacteria.

3. That each of the three main tunics has its peculiar manner of reaction when incised or otherwise subjected to trauma—the serosa adheres, the muscle retracts, the mucosa protrudes.

4. The fourth proposition offered as a principle is, to some extent, theoretical, and is given as a practical explanation of post-operative ileus and other pathologic phenomena that depend upon impairment of intestinal peristalsis.

## POST-GRADUATE TEACHING OF PROCTOLOGY.\*

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For thirty years past, there has been a great increase in the requirements of undergraduate medical education. Previous to this, medical education seems to have been a matter of chance or opportunity.

From a two winters' attendance of medical lectures, reinforced by some practical experience under the guidance of a medical preceptor, the subject has become so complex that in certain of our better institutions a bachelor's degree is required before a student may matriculate in medicine. In conjunction with the academic studies he may be required to have at least two years' credits in certain subjects correlated with the regular medical course, i. e., biology, chemistry and physics.

The undergraduate course at present consists of four years attendance in a medical college and, in my State, an additional hospital internship of at least one year before the candidate may come before the State Board of Medical Licensure to obtain the right to practice medicine.

With the introduction of medical specialties, the need of post-graduate courses became apparent. Like the undergraduate schools, these special schools had a rather crude beginning. Their requirements were none too high. Even in the best of them, about the only requirements were a diploma from a recognized medical school and the payment of a tuition fee, the size of the latter depending upon the nature of the course and the number of hours or weeks of instruction a student could pursue. The period usually chosen was from three to six months, and in rare instances a year, after which, if he so desired, he would either return to his home town, or some near-

by city, and establish himself as a full fledged specialist. Some students even combined two or more courses, and became multispecialists. One physician, after a three months' course, sent me a card stating that he was a specialist on the nose and throat, and on diseases of the anus and rectum; certainly a tactless combination.

It would seem obvious that the short-course route in special medicine by irresponsible and poorly prepared physicians is bound to be a thing of the past. Formerly, this was the easiest way to break away from general practice and gain a reputation in a special field. Just how much special knowledge—which might include a fair amount of clinical experience and practical observation—could be obtained in a six weeks' course, is left to the imagination.

We will have to admit that there were a goodly number of students possessing the necessary mental qualifications and high ethical ideals who developed rapidly in their chosen specialties, and became a credit to the community in which they practiced. Unfortunately there were a few, not of the same caliber, who became out-and-out charlatans, who never progressed because they couldn't progress, because they didn't know the way.

It must be remembered that specialization, like medicine in general, must go forward. In our day, with the development of medical and surgical groups, some, unfortunately, purely commercial, and others formed for the purpose of increased efficiency, the need of men whose opinions shall be authoritative in their special fields is keenly felt.

The development of the group system in medicine and surgery is but a highly commercialized form of the neglected possibilities to be found in every large hospital. While undoubtedly this new style of organization will greatly increase the earning power of the members comprising one of these groups, it is questionable whether any great contribution to medicine will be made that will be of benefit to the world at large. There is a great danger that there will be over-commercialization at the expense of altruism.

I hold that the proper place for the group plan should be in the general hospital, for in this way the greatest good would result to the greatest number, and the really poor could have the advantage of co-operative examination and treatment. There is no apparent reason why the system should not apply equally to the private practice of the members of the staff, modified, however, according to the special requirements necessitated by the local situation. A too close application to the group idea, while undoubtedly beneficial to its members, may result in a

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condition that will throw to the winds all of the tenets of our pet code of medical ethics. There is always the danger that the cordial relations that at present exist between the members of the medical profession of Philadelphia, or of any other city, may become strained, and that instead of progressing, there may be a reversion to the days of petty jealousies between members of the different schools, societies, hospital-staffs and groups.

To teach students to be effective surely requires more than six or twelve weeks. With this idea in view, the University of Pennsylvania has taken over the Philadelphia Polyclinic School of Medicine and the Medico-Chirurgical Medical School and organized them under the name of "The Medico-Chirurgical College and Hospital, Graduate School of Medicine of the University of Pennsylvania." This former is the legal name, but for purposes of brevity the name is "The Graduate School of Medicine of the University of Pennsylvania".

Quoting from an unpublished report by the Dean, Dr. George H. Meeker:—

"The school was founded in 1916; the first regular session began in 1920; courses under the standard plan began in 1921. The school is a pioneer in establishing a comprehensive American University System of graduate medical education.

"The educational equipment consists of a strong central organization, which directs the whole program and operates in complete coordination with an extensive group of associated graduate medical educational facilities.

"The basic idea is that of three years' university courses in each of seventeen well defined clinical and medical science departments; of a standard plan of courses which lead from fundamental instruction and study, through experience in special practice, science and teaching, to systematic research; and finally of producing medical men who shall be reasonably well qualified to pursue special medical practice, teaching and research.

"Admission to candidacies is based upon approval of credentials of high grade medical education, experience and ethics—under both American and foreign standards, according to the origin of the applicant.

"Broadly speaking, the keynote of the first year of a regular course is 'theory'; of the second year, 'practice'; and of the third year, 'research'.

"This division of work between the three years of a regular course is not intended to be strictly rigid. As a matter of fact, deviations must occur, according to the individual and to the department in which he labors; but the general spirit and purpose is to have the work in all departments insure the inclusion, and so far as practicable, the sequence of 'principles, applications and investigations.' "

In addition to this general scheme of extended special medical study, the Graduate School has addi-

tional Personal Courses. To quote the same authority:

"A graduate school of medicine should be a center in which all of the newer special medical theories and methods are under active discussion, investigation and exemplification. High type medical men, each one within his own special field, seek such centers for the benefit of contact with this newer knowledge, during brief or extended time-periods, according to the circumstances in each case.

"The University provides for this important graduate medical educational service through 'Personal Courses', each of which is offered by that member of its large faculty who is especially well equipped within the special field concerned. These personal courses are not of the so-called 'polyclinic' type, which plays no part in the University's general plan. The personal courses deal with highly specialized sub-departmental topics; and are designed primarily for the benefit of physicians who are already classed as clinical or medical science specialists."

A student who has demonstrated his fitness during his first year's course may be admitted to a definite graduate medical degree candidacy upon recommendation of his departmental faculty, and upon his own request.

At the completion of his second year's course, the candidate may have conferred upon him the degree of Master of Medical Science, while the third year leads up to the degree of Doctor of Medical Science, and would indicate "demonstrated capacity for medical teaching and investigation in a clinical or medical science department".

"A very important part of the Pennsylvania plan of graduate medical education is the upbuilding, as rapidly as possible, of an extensive cooperation between the central organization and extramural hospitals, clinics, medical laboratories, libraries, museums, institutes and societies. At present, forty-seven medical organizations are found in such a state of cooperation. . . .

"With regard to the cooperation as above, there is no thought that a cooperating unit must be located in Philadelphia. It may be located anywhere. In general, the student physician will receive at least his first year's graduate medical training in the principles of his selected subject, at the University; but thereafter, while still ranking as a student physician and candidate in the Graduate School of Medicine, he may be assigned, with no limitation as to locality, to any cooperating medical institution where he may, under approved extramural supervision and facilities continue with unquestioned profit his graduate medical studies and investigations.

"In such cases, the University will, after careful investigation, validate the assignment, receive frequent authoritative reports of the student physician's progress, and through the respective departmental facilities or staffs, make final evaluation of the work accomplished by the candidate."



It is under the supervision of the above comprehensive plan that the department of proctology has been organized. It will take some time to develop a thoroughly practicable organization, but considerable progress has been made.

For the purpose of personal contact, the number of special students in proctology has been limited to four. In addition, students from the surgical section attend the operative clinics; while those from the urologic and gynecologic departments have additional clinical instruction, as well as attendance on operative clinics. Clinical lectures are at times reinforced by the stereopticon, demonstrating rectal pathology, anatomy and variations in surgical procedure.

In addition to the cooperation between the urologic and proctologic departments, there is also a connecting link between, or a point of contact with, each of the other medical science and clinical departments. In this way the patient, the student and the teacher have the benefit of coordinated, highly specialized investigation and cooperative diagnosis.

During the first year, students attending clinics will have little opportunity to assist at operations, but they will be given practical operative work in the second year.

During the first year, students in the dispensaries are required to take histories of new cases and to assist in the post-operative and non-operative treatment.

Cases are assigned, and it is the duty of the student that proper notes be kept of the treatment and reports made of the progress of the case.

Special history and examination sheets are kept by the student. These reports are vided and signed by some member of the department. Free discussion of all things relating to the case is encouraged. In this way, a large amount of personal interest is developed.

For purposes of organization, the department of proctology works in conjunction with that of urology. At stated intervals a seminar is held, at which time certain students are assigned to read papers on special phases of their selected specialty. These papers are freely discussed by members of the departmental faculty.

As an aid to research, a library on proctology has been organized and placed at the disposal of the students. It would seem important that the student become familiar, not only with the newest facts in the specialty, but should have a comprehensive knowledge of the older writers.

A file of current abstracts and reprints is access-

ible and the students are encouraged to review current proctologic literature as published in the journals.

In Philadelphia a daily roster of operations scheduled in all hospitals is posted on the bulletin board of all subscribing institutions. Whenever feasible, students will be assigned to report upon one of these. This is made possible by the cordial cooperation of surgeons operating in other institutions.

Next year we expect that opportunity will be given for special dissection and demonstration in rectal pathology.

Classes will be held in surgical technic, at which time the student will be required to demonstrate on the cadaver the various surgical procedures in proctology.

More advanced students of the third year will be assigned certain original problems for investigation, and will be required to furnish an acceptable thesis before they may qualify for a degree.

Students will be encouraged, when possible, to visit the clinics of proctologists in other cities, thereby broadening their viewpoint and widening their acquaintance. This will tend to increase the cordial relations already existing between the members of our specialty.

As a suggestion, it would seem desirable that the American Proctologic Society should contribute to this plan by lending its cooperation to this great work. It would seem a perfectly feasible plan that certain members of this Society be designated as extramural preceptors in various cities, the student still being under the authority of the University's Graduate School of Medicine.

It is upon this rather ambitious program that the department hopes to develop men who will represent proctology in a dignified and ethical way; men who will be an honor to the profession and who will maintain proctology in its proper place; men who will make for the good of humanity; men who will so far surpass their teachers that their progress will prove the efficiency of organized post-graduate teaching in proctology.

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#### CATHETERIZATION AFTER ANAL STRETCHING.

After operations upon the rectum, especially after those involving divulsion of the sphincter ani, voluntary urination is apt to be inhibited for a day or more. This is especially the case when stretching is done in a sagittal direction, i. e., towards the urethra and the coccyx. It may save catheterization, therefore, if the stretching is done only laterally, i. e., towards the tubera ischii.



# SEPARATION OF RECTI MUSCLES OF THE ABDOMEN A CAUSATIVE FACTOR IN THE PRODUCTION OF PTOSIS OF COLON AND SIGMOID AND FECAL STASIS.\*

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Undoubtedly the separation of the recti muscles of the abdomen has been generally recognized by all surgeons, yet no significance has ever been attached to the condition. At the American Medical Association meeting in Detroit, June, 1916, I first called attention to this condition as a factor in producing acute angulation of the sigmoid. Since then I have examined a great many cases, which have strengthened my conviction that the separation of the recti muscles plays a very important rôle in producing not only ptosis of the sigmoid, but general enteroptosis as well.

The literature at my command does not mention this condition in connection with any abnormal disturbances. Lynch, in his book mentions the separation of the recti muscles as a possible cause of failure in closing incisions in the abdominal wall; Cohnheim, as translated by Fulton, advises us to look for this condition in the "habitus enteropticus", but does not state what importance is to be attached to it in the production of this condition. Lynch and Draper, in discussing my paper, stated that they had frequently observed the separation of the recti muscles without attaching any great importance to it, although in looking back over their work, they were in accord with my interpretation.

*Description.*—Normally the recti lie in close juxtaposition. Their sheaths are composed of the aponeuroses of the transversalis and oblique muscles which fuse between the two muscles to form the linea alba. The linea alba is the fixed point in the center for the attachment of the oblique and transversalis muscles of each side of the abdomen and as long as it remains intact the recti remain unseparated and perform their proper function.

If the linea alba yields, then the contraction of the oblique and transversalis of each side, pulling in opposite direction, draws the two muscles asunder, thus altering their proper function. The oblique and transversalis muscles, together with the recti, under normal conditions render the abdominal wall tense and support the viscera in position. During the act of defecation, in conjunction with the dia-

phragm, they compress the abdominal viscera firmly against the back, reduce the size of the abdominal cavity, and express the contents of the colon. If from any cause, the fibers of the linea alba should become weakened and separated, and therefore broadened, the recti would necessarily be pulled asunder and the muscles of each side lose the fixed point for contraction, and therefore the normal supportive function of the abdominal muscles would be lost. By such yielding and broadening of the linea alba, the muscles of both sides instead of making the abdomen tense, would bulge in the groins and thereby not only permit the colon, as well as the whole intestinal tract, to prolapse, but would lose the compressive and expressive power of these

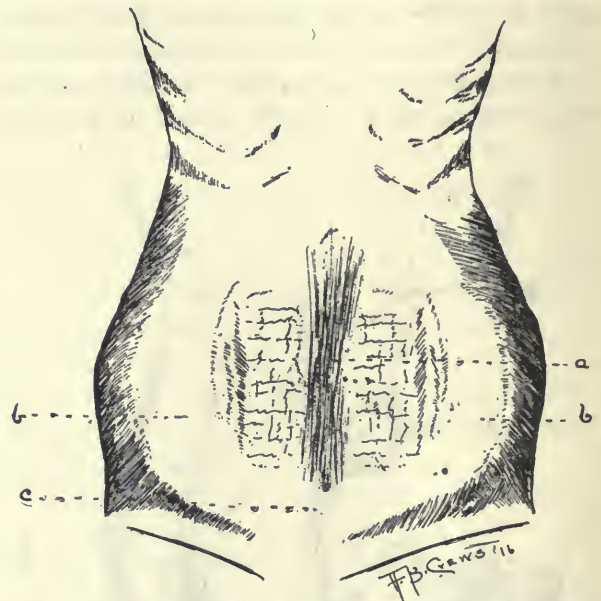


Fig. 1. a. Separation of linea alba. b. Groin bulging on account of contraction of transversalis and oblique muscles. c. Separation of pyramidalis muscles (original).

muscles in defecation. This condition, prolonged for any length of time, would result in partial, if not in complete ptosis of the intestinal tract, which always results in acute angulation of the sigmoid colon and fecal stasis.

*Classification.*—After repeated examinations of many cases, I find that the degree of separation may be classed as: (1) complete; (2) partial complete; (3) incomplete.

Complete separation of the recti muscles is a condition in which the fibers of the linea alba are completely separated from the xiphoid cartilage to the symphysis, with nothing but the skin and peritoneum intervening.

Partial complete separation is the condition of complete separation and division of the linea alba, as above, extending from the symphysis to the um-

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bilicus, the remaining fibers of the linea alba above the umbilicus remaining normal, or the fibers only partially separated.

Incomplete separation is a condition in which the fibers of the linea alba are only thinned out or separated, but not completely severed, leaving the linea alba much broadened and destroying it as a fixed point of attachment for the opposing muscles of the two sides.

Any of these conditions will in time, by removal of their supportive action, cause a partial or a complete enteroptosis. All cases of enteroptosis, however, do not have this separation of the recti, but I have yet to see a case with the separation of the recti in which there was not also enteroptosis with acute angulation of the sigmoid and fecal stasis.

*Causes.*—The causes of this condition are almost as many as the number of cases. In the acute cases and in the young, it is usually caused by some sud-

den hours at hard work on the feet; wasting diseases; improperly fitting clothing; injudicious use of belts; long continued and unrelieved severe coughing, as in senile bronchitis or chronic asthma; or any general constitutional condition whereby the general nutrition of the body is lowered and the digestive system impaired.

*Diagnosis.*—The diagnosis of the condition is simple. With the individual lying in a recumbent position, place the tips of the fingers of each hand at right angles to and along the linea alba, and have the individual forcibly raise his head and flex the chin tightly upon the chest. In this position, the recti muscles are rendered very tense, the fingers slip down between, and there will be a distinct grasp of the fingers by the closing of the recti. By having the individual strain as if in the act of defecation, the ptosis of the intestinal tract will be readily observed, for the abdomen immediately balloons at the lower end and there is a great bulging in the two groins. Some cases are more pronounced than others, according to the degree, but this simple method is effective.

#### ACUTE PROCTITIS

Among the causes of proctitis, the following may be mentioned: Irritants directly attacking the mucous membrane, such as worms, highly seasoned foods or hard substances in the fecal mass, for instance, fish bones and hulls of cereals. Fecal irritants are common causes both of the acute and the chronic type. Constipation and fecal impaction of the rectal pouch alternating with periods of liquid feces often induce a sudden inflammation of the sigmoid flexure and rectum, or the rectal disturbance may be an extension of colitis resulting from passage of the irritating discharges from above. Seasonal changes of food or water, particularly during the summer, or sitting on a cold wet seat are exciting causes. This is particularly so in individuals suffering from rheumatism, gout or chronic skin diseases. In all of these conditions, sudden and violent changes are important factors. Proctitis may result also from the use of strong purgatives, irritating suppositories or as an extension of inflammation from hemorrhoids, prolapse of, or eczema about the anus, or from disease of the neighboring organs, such as the bladder, prostate gland, vagina or uterus. In a few instances, new growths within the rectum, such as polypi, adenoma, villous growths and papilloma, also intussusception, occasion periodic exacerbations or protract the chronic proctitis. — CHARLES J. DRUECK in *The Medical Fortnightly*.

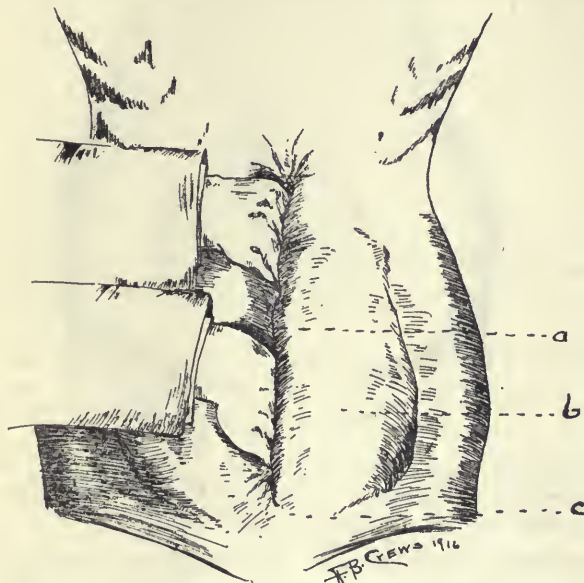


Fig. 2. Method of examination. a. Complete separation of linea alba. b. Bulging in the groins, due to contraction of the transversalis and oblique muscles. c. Separation of pyramidalis muscles (original).

den violence, such as an unexpected and sudden misstep or sudden and excessive fit of sneezing, coughing or lifting, or any violence requiring rather sudden and unexpected straining. This is also particularly true in young men, following operations on the abdominal wall. These conditions are true of both young males and females. The more frequent cause in the female is a superabundance of amniotic fluid. There are many other causes too numerous to mention. In the chronic cases, the condition comes on gradually and insidiously: increasing constipation, with unrelieved straining;



## RECTO-COLONIC HYDROTHERAPY.\*

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One is fairly safe in saying that the great majority of those habitually taking laxative drugs began that pernicious practice in trying to relieve what was primarily only a simple prolonged retention of feces in the rectum, or in the sigmoid colon. Granting that this be so, then, as Alvarez has tritely put it, "Why upset twenty-four feet of intestine with a purgative when the material to be removed is in the rectum or sigmoid within easy reach of a little water?" An answer to this query is that but few individuals ever consult a physician before their constipation becomes chronic, and so fail to learn that an enema would be the best remedy to relieve their trouble quickly and efficaciously. Moreover, even when so advised, they usually, like all average humans, seek the path of least resistance, finding it far easier to swallow a daily pill which helps to aggravate their trouble, than to bother (as they term it) with an enema—which gives better and far more lasting results, within a few moments, than does the pill in as many hours.

Probably all of us have often noticed how meager is the knowledge of the average nurse concerning the correct preparation and administration of enemata and colonic irrigations; and how, as a result, too frequently discomfort and even distress follow these excellent therapeutic procedures, which are intended to give only comfort and relief.

In order to be perfectly fair in the matter, it is but right to state frankly that this seeming lack of knowledge on the part of the nurse is perhaps often due to the fault of the attending physician, who, as a rule, perfunctorily orders a low or high enema, as the case may be, and then takes it for granted that the nurse understands exactly what he wants. Rarely does he give any directions as to the exact composition, quantity, and temperature of the solution he wishes to have injected, the height to which the reservoir is to be raised, or the posture in which the patient is to be placed. In some instances it may be questionable whether the physician would be able to tell the nurse, should she venture to ask for complete directions.

As a result, this is what often happens, unless the

nurse has been especially trained in this work. An excessive amount of a too-warm solution is put into an irrigator, which is then raised to an indifferent height (generally too high) above the patient's buttocks. A rectal tip, or colon tube, is lubricated (sometimes wrongly with glycerine) and inserted into the rectum without any consideration whatever being given to the true direction of the anal canal. If the colon tube is what is used, it is pushed up into the bowel as far as will suit the idea of the nurse who is giving the enema at that particular time. Then, to speed the flow, oftentimes the irrigator is raised to a greater height. Should the pain from the too rapid overdistension of the rectum cause the patient strongly to demur, patience is urged upon him, while still more fluid is injected.

Withdrawal of the tube is not infrequently promptly followed (and sometimes preceded) by an uncontrollable gush of water and fecal matter from the bowel. While this gives grateful relief to the patient, it is a source of considerable chagrin and annoyance to the nurse.

When a high enema is ordered it generally means a repetition of the procedure just spoken of, only that a greater length of tubing is inserted and considerably more solution injected. In fact it has seemed to me as if the impression was that the more tubing was made to disappear up the bowel the more scientifically the high enema was given.

Criticism, unless it be constructive, is usually of little value. Therefore I presume to offer a few suggestions which I think may remedy the faults at issue. One is, that the physician, when ordering enemata or colonic irrigations, should give as explicit directions for their administration as he does when prescribing potent drugs and special dietary. The nurse should be told when and how they should be given, what solutions should be used, and the exact quantity and temperature of the same, the posture in which the patient should be placed, and how long it is desirable that the fluid be retained.

Another suggestion is that, whereas recto-colonic hydrotherapeutic measures are employed almost daily by those caring for the sick, and whereas there are certain dangers connected with their incorrect and unskilful administration, hospital training schools for nurses should pay far more attention to the subject than they are now doing.

A brief lecture or two on the anatomy of the colon, rectum and anus—especially if illustrated by schematic drawings—will enable the students to get a much better understanding of their contour and rel-

\*Read before the American Proctologic Society, June, 1921.



ative positions in the body. After being taught that the axes of the anus and the rectum lie in entirely different planes, they probably will take more care thereafter when inserting tips, tubes, and thermometers. When from *x*-ray plates they can see that a soft colon tube only coils upon itself in the rectal ampulla, instead of proceeding up the bowel as they supposed it did when inserted for a considerable length, it will teach them the futility of such a procedure.

When it has been explained to them that the pelvic colon acts principally as a reservoir for the feces, and that the rectum is essentially an expelling organ, they will the more appreciate why overdistension of the latter by too large enemata is so apt to be followed by serious consequences. And further, when they learn that the anal portion of the bowel is most highly sensitive, and has a mucosa which is very easily abraded, they will better understand why gentleness in manipulation is so necessary at all times.

A short talk on the more common pathological conditions of the anorectal region, which they are apt to meet with in their future work will make them aware that there may be other lesions occurring in these parts besides hemorrhoids, and that one in particular, fissure of the anus, is often caused by the rough insertion of instruments, hard-rubber rectal tubes, and thermometers.

Instruction should be given on the indications for, and the preparation of, the different kinds of enemata, such as the ordinary evacuant enema, the turpentine enema for tympanites, the peroxide of hydrogen enema for fecal impaction, and the emollient enema of starch or linseed decoction for soothing the irritable rectal mucosa, to mention but a few. At the same time a talk on nutriment enemata should not be neglected, even though this may be considered more a problem of dietetics than of recto-colonic hydrotherapy.

Just how an enema stimulates bowel movement should be explained. From this the student will learn that fluid, through distending the bowel, acts mechanically as a powerful stimulus to contraction, and after learning this, greater care will be taken in injecting solutions more slowly and under far less pressure. When they comprehend how this will lighten their work by lessening the soiling of bed and patient, they will give more time and attention to a procedure which was before done in haste and with indifference.

After learning that water at a temperature of more than a few degrees above that of the body is in-

jurious when injected into the bowel, whereas that considerably below it, through the thermal stimulation it causes, is decidedly efficacious, they will understand why a small enema of very cold solution will accomplish quicker and better results than a larger one of much higher temperature.

It should be impressed upon them that irritating substances, which act as chemical stimulators, should be employed with caution, and that none should be used daily over long periods, as they tend to diminish the normal sensibility of the mucous membrane. This applies particularly to the ordinary soap-sud and the glycerine enema so commonly employed by the laity as well as by nurses.

Since boric acid enemata are in extensive use, nurses should be especially warned against leaving any large amount of that solution in the bowel, on account of the severe and even fatal poisoning which might result therefrom.

I would suggest also that nurses be advised always to use a soft-rubber catheter, with a caliber about that of a lead-pencil, when giving an enema, for the reason that the comparatively soft, rounded, closed end is not apt to injure the anal mucosa as is the hard-rubber tip or the colon tube with their sometime sharp open ends.

I believe that such a course of lectures, given by a competent teacher, will be not only very instructive, but will serve to make nurses more interested in a particularly valuable therapeutic measure which they now consider only a disagreeable task.

Passing now to colonic irrigations: To my mind these should be given only by a physician or by a nurse-assistant who has been especially trained in this work. While it is true, as demonstrated by the roentgenologists, that heavy thick fluids, under a constant pressure of three feet, or even less, reach the cecum without difficulty and without the necessity for the patient assuming any special position or series of positions, yet daily clinical experience teaches us that watery solutions are usually arrested for a time at the recto-sigmoidal junction by a spasm of the valve of O'Beirne, and do not progress onward until the valve relaxes or is overcome by pressure from below. The latter means a possible overdistension of the rectum itself, and regarding this, I can but agree with Butler, who has written that: "As a single overdistension of the bladder, lasting no more than a few hours, may be followed by a life-long weakness, a single overdistension of the intestine may seriously weaken its normal rhythm. Therefore, instead of being indifferent to posture, why



should we not, when possible, place the patient in the knee-chest or knee-elbow position? This will straighten out the bowel in a line with the rectum, and just as it facilitates the introduction of the sigmoidoscope, so will it do the same for the irrigating fluid. Then, after sufficient solution is injected, if the patient will lie on his right side, it rapidly flows to the cecum without causing the least distress.

What I think may be termed the most scientific method of administering a colonic irrigation is to introduce the sigmoidoscope to a point beyond the recto-sigmoidal valve. Through this a small-sized, olive-tipped Wales bougie is put into the sigmoid. One can then be perfectly sure that the fluid runs only into the mobile and distensible part of the large bowel. In this way larger quantities of solution can be easily injected, under fairly low pressure, without in any way over-distending the bowel walls or disturbing the patient. Personally, I rarely inject more than one thousand c.c. at a time, as in my experience this amount accomplishes as much as a larger quantity, while at the same time I am reasonably sure that no harm is being done:

By means of the simple arrangement now to be described, I have been giving colonic irrigations without employing the sigmoidoscope or injecting fluids at a high pressure.

A double-ended hand bulb is attached to the tubing leading from the irrigator. At the free end of the bulb is fastened a foot of rubber tubing, to which, in turn, is attached a tapering glass connector. A shut-off clip on the tubing at each side of the bulb completes the apparatus.

It is used as follows: The irrigator is filled with 1000 c.c. of solution: Both clips are opened. This allows the bulb to fill with fluid, while at the same time all the air in the bulb and tubing is expelled. The clips are then closed.

With the patient in the knee-elbow position, a well-lubricated Wales bougie, olive-tipped, with a fairly soft neck, and about 13 mm. in diameter, is inserted into the rectal cavity for a few inches. To this the tubing from the irrigator is connected by means of the tapering glass tip.

The clip distal to the bulb is then opened, and the contents of the bulb slowly expressed by hand pressure. It is then closed and the clip nearest the reservoir is released. This allows the bulb to refill. This clip is in turn closed, the distal one opened, the bulb again expressed, and this operation is repeated until all the fluid has been injected.

All this time the bougie is being slowly and care-

fully advanced. Should it impinge on a valve of Houston or against the bowel wall, the olive tipped head bends at a sharp angle on the neck, and the flow of water is cut off. As this prevents the contents of the bulb from being further expressed, the obstruction to the advancement of the bougie is immediately made evident to the operator, who then withdraws it slightly until a point is reached where the water flows in freely again, after which the bougie can be once more advanced.

The pressure from the bulb aids in opening the bowel lumen, thus facilitating the passage of the bougie. The expression of two or three bulbfuls is usually required to assist the bougie in passing beyond the recto-sigmoidal valve. At times some little difficulty is experienced in getting it past this valve. No force should be used. With a little patience, after gentle and quiet manipulation, the tip of the bougie will be felt by both patient and operator to spring suddenly past the obstruction, and after this the fluid will flow in very easily.

Following the injection of the solution, the patient lies on his right side for a short time, after which he may retire to the lavatory. In those cases where it is advisable that the entire bowel wall be bathed by special medicated solutions, as in ulcerative colitis for instance, the patient before expelling the irrigation is made to turn from side to side while lying alternately on his back and abdomen.

Patients frequently come for treatment who exclaim that they are unable to retain an enema even though it be only a small one, and it is to these individuals in particular that it comes as an agreeable surprise that during and after the administration of the irrigation, given as I have described it, they experience no sense of urge or discomfort whatever, and that when permitted to arise from the table they need be in no special hurry to dress before retiring.

In conclusion, I will add that as an office procedure it enables many to receive treatment who otherwise might neglect themselves if they were required to remain at home or in the hospital.

#### DIAGNOSIS IN HEMORRHOID CASES.

A radical operation for hemorrhoids should not be undertaken until the etiology of the piles has been determined. Sometimes the cause is an obstruction in the portal circulation due to hepatic disease. Per contra, abscess of the liver may be due to infection from a hemorrhoid operation performed even some months before.



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WALTER M. BRICKNER, M. D., F. A. C. S., Editor.  
New York City

ELMIRA, NEW YORK, DECEMBER, 1921.

### BLEEDING FROM THE RECTUM.

When a layman suffers pain or, especially, bleeding, at stool, he almost invariably jumps to the conclusion that he has "piles." This presumption, so often faulty, is harmless, if it does not lull the individual into neglect of the condition. What is more surprising is that so many physicians who ought to know better, accept his explanation without an examination—which is wholly reprehensible—or agree in this mistaken diagnosis even after having made some sort of an examination!

How often a practitioner sends to his surgical colleague for hemorrhoid operation a patient with a projection at the muco-cutaneous margin of the anus that is not a hemorrhoid at all, but merely the so-called "sentinel pile" "half concealing, half disclosing" the fissure or ulcer which produced it and which is the sole cause of the pain and bleeding!

*Hemorrhoids that cannot be plainly demonstrated as such, visibly and palpably, do not exist.* In such cases some other source of the symptoms must be sought. Indeed, in all cases, whether hemorrhoids are found or not, an examination should be made to determine the presence of other lesions in the anus or the rectum; for it not infrequently happens that hemorrhoids, bleeding or otherwise, exist with other conditions (fissure, fistula, proctitis, carcino-

ma) as an unrelated complication or as a manifestation. Nor ought it to be necessary to emphasize the importance of seeking a possible etiology for hemorrhoids in hepatic, cardiac or other disease.

Since they are rare in children, rectal bleeding in these young subjects is not often mistakenly attributed to hemorrhoids. In most cases it is due to a polyp, a pro'apse or an intussusception. A perineal dermoid situated in the commissure of the anus resembles, at first blush, and may be mistaken for, a large "external" hemorrhoid. It is not difficult to make the differential diagnosis.

### RECTAL CANCER.

The "combined operation" for carcinoma of the rectum has steadily grown in surgical favor in the last decade. It seems to us that it should *always* be employed, even in cases in which the growth is so favorably situated that it appears to be readily extirpable by the vaginal, perineal or sacral route alone. In the first published, and much-quoted, description of Tuttle's operation (the JOURNAL, June, 1910), he admirably described his technic of abdominal separation of the gut to insure the blood supply of its proximal segment—a most important consideration—and, in summarizing the advantages of the combined operation he mentioned: "First, it affords an opportunity to examine the abdominal organs, the glands, and the peritoneum with regard to metastases. If these exist the extirpation is not justifiable." This feature of the combined operation is not often enough emphasized, therefore we again refer to it in these columns. It is only by an abdominal exploration that a forbidding metastasis can be discovered, and such a metastasis may exist in a case that, without such exp'oration, would have appeared quite favorable for radical operation.

### AN OPERATION TO EFFECT CURE OF ISCHIO-RECTAL ABSCESS.

All of the contributed articles in this issue of the JOURNAL were read at the 22nd annual meeting of the American Proctologic Society, in Boston, June, 1921, except the article by Guilford Dudley in which he reports his conclusions concerning the etiology of ischio-rectal abscesses, and describes an operation planned to effect cure without recurrence or residual fistula. His procedure is fundamentally so different than the usual simple incision (notoriously unsatisfactory as to totality of cure) that we commend its careful consideration and trial to all surgeons.



## DWIGHT H. MURRAY.

In the sudden death, on October 21st, of Dr. Dwight H. Murray of Syracuse, American proctology lost a conspicuous figure, an earnest worker. At the time of his demise, at the age of sixty, he was professor of clinical proctology in the Syracuse University College of Medicine, proctologist at the Syracuse Memorial Hospital for Women and Children, and the Hospital of the Good Shepherd, Speaker of the House of Delegates of the American Medical Association and Vice-Speaker of the corresponding body in the Medical Society of the State of New York. He was very active in the affairs of both of these associations, and had been the first chairman of the Section on Gastro-enterology and Proctology of the A. M. A. He was also an ex-president of the American Proctologic Society.

In the scientific field Dr. Murray will be most remembered by his researches in the etiology and treatment of that common and distressing disorder, pruritus ani. In a large percentage of cases he found in the perianal skin an organism which he believed to be specific and which he named the *streptococcus fecalis*. By the administration of vaccines from this organism he was able to cure or greatly relieve many cases. In his contribution to the last Proctologic Issue of the JOURNAL (February, 1920) he wrote:

It is now nine years since I read my first paper setting forth what I had proved to my own satisfaction to be the etiology of pruritus ani, one of the most stubborn diseases that we have to treat. My first papers when published brought forth the usual crop of scoffers and unbelievers, but they were all numbered with those who had not investigated the truth or falsity of the claims . . . It has now been my satisfaction to see one after another of those who at first did not credit the infection theory, acknowledge that it has been proven correct, and others found the infection in a greater percent. of cases than I had published.

## Progress in Surgery

Selections from Recent Proctologic Literature

**Rectal Cancer; Operative Methods.** HENRY O. SOMMER, Washington, D. C., *Medical Record*, October 15, 1921.

Sommer comments on the Kraske operation, "the abdominosacral, or as it would be better named, the abdomino-spatium-sacro-ischiadicum method," the perineal, the abdomino-perineal, the vaginal and the abdomino-vaginal operations for extirpating rectal cancer. He says it is largely a matter of specific indication as to which method shall be applied and that none of them have been "relegated to the junk heap." Pennington has done a service, he says, by showing that a group of 218 have survived three years, and a group of 130 cases 5 years or more.

Sommer concludes: "As to the future benefits to patients it is clear, from the size and adjacent complications of the growths of tumors of the rectum and sigmoid which come to the master operating surgeons, that the general practitioner must more early suspect, scrutinize, and conscientiously interpret ill-defined anal, rectal, and abdominal symptoms and use the instrumental rectal and sigmoidal examinations, especially higher up and have x-ray plates made rather early, even if they turn out negative, rather than too late!

"Unless Pennington's interpretation of the results obtained by radium in rectal carcinoma can be disproven by more comprehensive work and publications he has virtually shown that radium is only a palliative for definitely and absolutely 'inoperable cases,' which is itself not a definitely standardizable term as yet, depending much upon the ability of the surgeon, and that some temporarily inoperable growths or allegedly inoperable growths were made fit for or possible of removal by operation. Hence in those patients who 'absolutely refuse intervention' but are 'operable' it would seem more conscientious not to yield too much to the patient's notions and spend a little effort in advising him to be operated upon, even though this may take some moral courage that may not react to the benefit of one's popular reputation in case of a fatal outcome by operation, for if the case does later progress to almost inoperability the operation and after-treatment are not a comedy for either patient or surgeon, and unfortunately such are the cases that form the bulk of statistics, and are the cause of the low 3 year limit of duration 'cures' before recurrence. It is also a surgical maxim that those methods of operation alone which offer a clear examination of the adjacent structures, and thorough mechanical work and eradication are the only ones which offer safe immediate results and relief of sufficiently long duration to make them worth while for the patient to undergo the risk of operation, for the average operative mortality rate is 15.6 per cent, and is still a risk that must be considered by a man with a conscience even if it does show 84.4 per cent on the favorable side of the balance. Those methods which make this thoroughness possible, with judicious selection and prudent but courageous application, are the combined methods—and they are no novelty—the abdomino-spatium-sacroischiadic, the abdomino-perineal and the abdomino-vaginal, though possibly not always in the order named. They have no sole originator and the names of their various originators and modifiers are a secondary matter, and have been amply honored, but their literary controversies, while they have helped some, have tended somewhat to obscure the issues by a mass of brilliant names whereas it is the principles they have demonstrated and expounded which are valuable, based on a thorough study of the anatomy and pathology of the pelvis and abdomen and its surgical technic".

**The Operative Treatment of Hemorrhoids.** Discussion in the Section of Proctology, 89th Annual Meeting of the British Medical Association. *The British Medical Journal*, October 15, 1921.

In the opening paper SIR C. GORDON-WATSON, London, presents statistics of 1,000 consecutive hemorrhoid cases at St. Mark's Hospital and discusses technic, after-treatment, results and complications. Concerning the choice of operation, he says:

The ligature operation in the absence of acute inflammation is suitable for all cases, and because of its simplicity should be the operation of choice in the great majority of cases. Clamp and cautery is an admirable operation in selected cases, and when the case is a suitable one for this operation it has decided advantages over the ligature operation. It is bloodless, and pain after operation is less than after ligature or Whitehead. The average length of stay in hospital is shorter than after the ligature operation. Contraction never occurs, and all post-operative complications are less prone to occur than with the ligature or the Whitehead operation. Contraindications are as follows:

1. When hemorrhoids are partly covered by skin the operation, unless combined with a cutting operation, is unsuitable; consequently a third or more of the cases are ruled out.

2. When the hemorrhoids exceed three in number or cannot be grouped into three clamps (or four at most) it is not suitable, partly from manipulative reasons, and partly because there is not enough mucosa available in the circumference of the anal canal to allow more than three (or at the most four) hemorrhoids to be clamped at one and the same time. To apply a clamp in one place after the cautery has been used in another presents obvious dangers.

The operation is especially suitable:

1. In strangulated cases, or cases of prolapse with in-



flammation, when operation cannot be delayed for fear of strangulation.

2. For patients who require to get back to their work as quickly as possible.

3. For the aged, debilitated, anaemic, and very nervous people, who require to be spared as much pain and loss of blood as possible.

Against the operation is the fact also that it is less fool-proof than the ligature operation. An inefficient clamp and cautery operation might be followed by violent recurrent hemorrhage, and in consequence is not, he thinks, so safe an operation for private practice, outside a hospital. Stout ligatures give a greater sense of security to the surgeon at a distance. As regards secondary hemorrhage, figures show that the clamp and cautery operation is no more liable, if anything less liable, to secondary hemorrhage than the ligature operation. The clamp and cautery operation, however, is more prone to produce large tags.

The Whitehead operation is a radical method which gives excellent results in experienced hands. For the great majority of cases, however, it is an unnecessarily severe operation, involving, as it often does, considerable loss of blood. Great care is required in the after-treatment to avoid anal stenosis or extroversion of mucosa with a moist anus, which is often followed by pruritus ani. In some instances incomplete control both of flatus and feces follows the operation. The average length of stay in hospital of patients operated on by Whitehead's method is nearly double that of the clamp and cautery operation. It is, however, the best operation in skilled hands when there is a complete and extensive ring of hemorrhoidal tissue and bleeding is a marked symptom, or when hemorrhoids are complicated by severe pruritus ani or by multiple anal fissures and submucous pockets (the pre-fistulous state). It is not a good operation for the inexperienced surgeon.

Of 49 cases treated by injections of 20 per cent. carbolic acid in glycerin (5 to 10 min.), 33 were cured and 9 improved. Operation was subsequently required in 7. The only complication was an abscess in one case.

D. P. D. WILKIE, Edinburg, says pain and retention of urine—the two bugbears of the operation from the patient's point of view—are due to one or more of three faults in the operation. First and foremost, failure to provide free drainage, with consequent edema of the anal region; second, the inclusion of a few fibers of the sphincter muscle in the ligature or stitch applied to the base of the hemorrhoid; third, bruising and tearing of the sphincters from forcible and excessive stretching. The latter procedure is usually unnecessary altogether, and if required should be done slowly and gently. There need be relatively little pain associated with the operation, and retention of urine is quite unusual if the foregoing points are attended to.

Stricture following the operation is rare. The only cases of stricture which Wilkie saw have been after an imperfectly performed Whitehead's operation. This operation should never be performed. A good rule in any operation for hemorrhoids is to err on the safe side by removing too little tissue rather than too much, provided always that no actual formed hemorrhoid is left behind. Recurrence after any well-executed operation is quite exceptional. If met with, recurrence is usually early, and is really a continuance of the trouble owing to one or more piles having been left behind. The majority of cases requiring operation are of the combined intero-external type.

The only operations which at the present day demand consideration are the injection method, the clamp and cautery, and the ligature operation in one form or another. The clamp and cautery operation is the most painless of all the operations, and it appears to be singularly free from risk; the only objection to it is that it is perhaps less radical than some forms of the ligature operation.

LOUIS J. HIRSCHMAN, Detroit, U. S. A., in discussion said: In America the majority of proctologists are using local anesthesia to a far greater extent than is being done on this side of the water. He operates upon practically all cases of hemorrhoids, fissures, polyps, and all other kindred diseases of the rectum and anus under local anesthesia unless there is some very decided reason for using general anesthesia.

About 25 per cent. of our fistula cases are operated upon also under local anesthesia. We frequently combine the use of sacral anesthesia with that of purely local anesthesia.

The type of operation used by almost all the American proctologists is some modification or other of the incision and ligature method. The use of the clamp and cautery is restricted to those cases where there is a great amount of prolapse; for the cicatricial contraction following a burn is of distinct advantage in the ultimate result following an operation for prolapse.

In the injection method of treating hemorrhoids Hirschman does not use carbolic acid at all in his practice. We get very good results from the employment of a 5 to 10 per cent. solution of quinin-urea hydrochlorid. Each hemorrhoid is injected to mild distension with this solution, and is reinjected at the end of five to seven days if necessary. This solution causes a deposition of fibrin around the blood-vessels, which, becoming organized, shuts off the circulation to such an extent that the mass rapidly atrophies. If one is particular to inject the solution deeply into the tumor, and not to deposit it directly into or beneath the mucous membrane, sloughing is never encountered. The average length of time for a hemorrhoid patient to be entirely relieved is from three to four weeks.

The Whitehead operation he never employs, because no matter how severe the case, there is always a better way of disposing of the redundant mass by elliptical excision; the resulting scars are always in the longitudinal axis of the bowel, and the functional result is ideal. The less we talk about the Whitehead operation the sooner it will be discarded.

ERNEST MILES, London, pointed out that there were three stages in the development of piles; one cause of failure was that early piles were overlooked because they were obscured by others more advanced. Again, there were three primary fixed positions for hemorrhoids, besides four other secondary positions where they might develop. When all these positions were not carefully examined a pile might be missed.

**Proctientia Recti.** T. CHITTENDEN HILL, Boston, Mass. *The Boston Medical and Surgical Journal*, October 13, 1921.

After discussing etiology and methods of treatment Hill says that in the great majority of prolapses an operation on the anal orifice should be the one first attempted. The operation which he practices aims to support the upper rectum by a method of linear cauterization and at the same time to prevent the prolapse by narrowing the anal canal. There is no doubt that a small percentage of complete prolapses were cured by the old operation of linear cauterization, which sets up adhesions between the rectal wall and the sacrum. He begins the operation by pulling out the rectum to its full extent, where it is held by two tenacula. Beginning at the apex of the protrusion, the mucous membrane is seared with the actual cautery to within two inches of the anal orifice. Hill aims to cause a distinct narrowing above the internal sphincter by removing all the mucous membrane of the anal canal by the ligature method. The mucous membrane is seized with artery forceps and while elevated is dissected up for an inch or more. This should be done in sections, removing a quarter or more of the anal circumference at one time. As the assistant pulls down on the mucous membrane, a quarter section is ligated as high up as possible. In some instances it is advisable to use a double ligature to preclude the possibility of too much contraction at the site of the ligature. The aim should be to leave an aperture in the rectum at this upper level that will scarcely admit the little finger. After the ligatures are all in place, three or four interrupted catgut sutures are placed around the anal canal where it has been denuded of mucous membrane. This will effect a further narrowing of the canal "V"-shaped wedges of skin are now dissected off from the external sphincter at three or four points. This leaves a gaping wound of about three-fourths of an inch in width. The wound is united as follows: With a curved needle, using silkworm gut, a deep suture is placed about the middle of the wound, rather deeply through the external sphincter muscle (a stay suture) and tied. The suture of the skin is completed with plain catgut.



















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